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Corvallis Environmental Research Lab., Oregon

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Ecological Research Series

NEW YORK BIGHT SUSPENDED MATTER AND OCEANOGRAPHIC DATA: 1973 – 1974

Environmental Research Laboratory
Office of Research and Development
U.S. Environmental Protection Agency
Corvallis, Oregon 97330

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NEW YORK BIGHT SUSPENDED MATTER AND OCEANOGRAPHIC DATA: 1973-1974

Total Suspended Matter: Traverse Stations June, 1974, and Prior Cruises

Total Suspended Matter and Physical Oceanographic Data June-July, 1974 Cruise

Total Suspended Matter, December, 1974 Cruise

by

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FOREWORD

Effective regulatory and enforcement actions by the Environmental Protection Agency would be virtually impossible without sound scientific data on pollutants and their impact on environmental stability and human health. Responsibility for building this data base has been assigned to EPA's Office of Research and Development and its 15 major field installations, one of which is the Corvallis Environmental Research Laboratory (CERL).

The primary mission of the Corvallis Laboratory is research on the effects of environmental pollutants on terrestrial, freshwater, and marine ecosystems; the behavior, effects and control of pollutants in lake systems; and the development of predictive models on the movement of pollutants in the biosphere.

This report describes work performed in New York Bight as one aspect of an EPA study relating to the discharge of wastes from the New York-New Jersey metropolitan area. It is one of a series of data reports relating specifically to sewage sludge discharged from vessels into New York Bight.

A. F. Bartsch
Director, CERL

ABSTRACT

The concentration and size of particulate matter suspended in the water column were determined as part of an overall study of sewage sludge dispersion in New York Bight. Sampling points were established along a traverse which extended from New York Harbor, through the dump zone, to buoy NB. Data obtained from surveys in 1973 and 1974 are given in this report along with other oceanographic data obtained during a June 27-July 1, 1974 cruise.

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Dr. Jack Pearce of the Sandy Hook Marine Laboratory supplied us with storage, dock space and other amenities without which a difficult operation would have been more so.

SECTION 1
INTRODUCTION

This is the first volume of a projected series of data reports on a study of municipal sewage discharged from sludge disposal vessels in the New York Bight area (Figure 1). Included in this volume are data on total suspended matter (TSM)[1] collected between August, 1973 and December, 1974 and physical oceanographic data collected during the June-July 1974 cruise. Volume II treats the physical oceanographic methodology in detail and contains physical data for the December 1974 cruise. Volume III gives data on sewage sludges collected from several sewage treatment plants in the New York City metropolitan area. Preliminary analysis of these data has been presented by Callaway et al. (1976).

Sludge, defined as the residue resulting from primary and/or secondary waste treatment operations, and other waste materials have been dumped in the Bight area for many years; the effect of these materials on the endemic fauna and flora has been the subject of much study (e.g., Pearce, 1972) and even more controversy. It is estimated that 4.26×10^6 yd^3 (3.26×10^6 m^3) of sewage sludge, containing 4.5 percent solids by weight, are disposed of annually in the dump grounds (Pararas-Carayannis, 1973). The existing dumping ground is alleged to be overloaded and too close to the longshore residential and recreational areas of New Jersey and Long Island. New dumping grounds further offshore have been identified.

After discharge from a sludge vessel, the wastes will be transported and diffused throughout the water column. Most particles will settle to the bottom at rates depending on their settling velocities, flocculation rates, and initial momentum. The accumulation of sludge particles on the bottom will depend on the velocity profile near the bottom and horizontal and vertical diffusion and velocity profiles. The complexity of this process is obvious. To predict the fate of materials requires a mathematical model which will simulate as much of the detail of the physics as possible.

Sludge is discharged by gravity through several ports in the hulls of the disposal vessels. Initially, the sludge is discharged at about 4.5 m below the surface; when emptied each vessel will have risen about 2 m. Normally, the vessels discharge while underway, optimizing the dilution and dispersion of sludge. Discharges of this type were studied during the June-July 1974 cruise. For the December 1974 cruise, variances were obtained from regulatory agencies which permitted the vessels to stop and discharge at a single point.

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[1]TSM is referred to in this report as that particulate matter retained on membrane filters which have nominal pore diameters of 0.45 um.

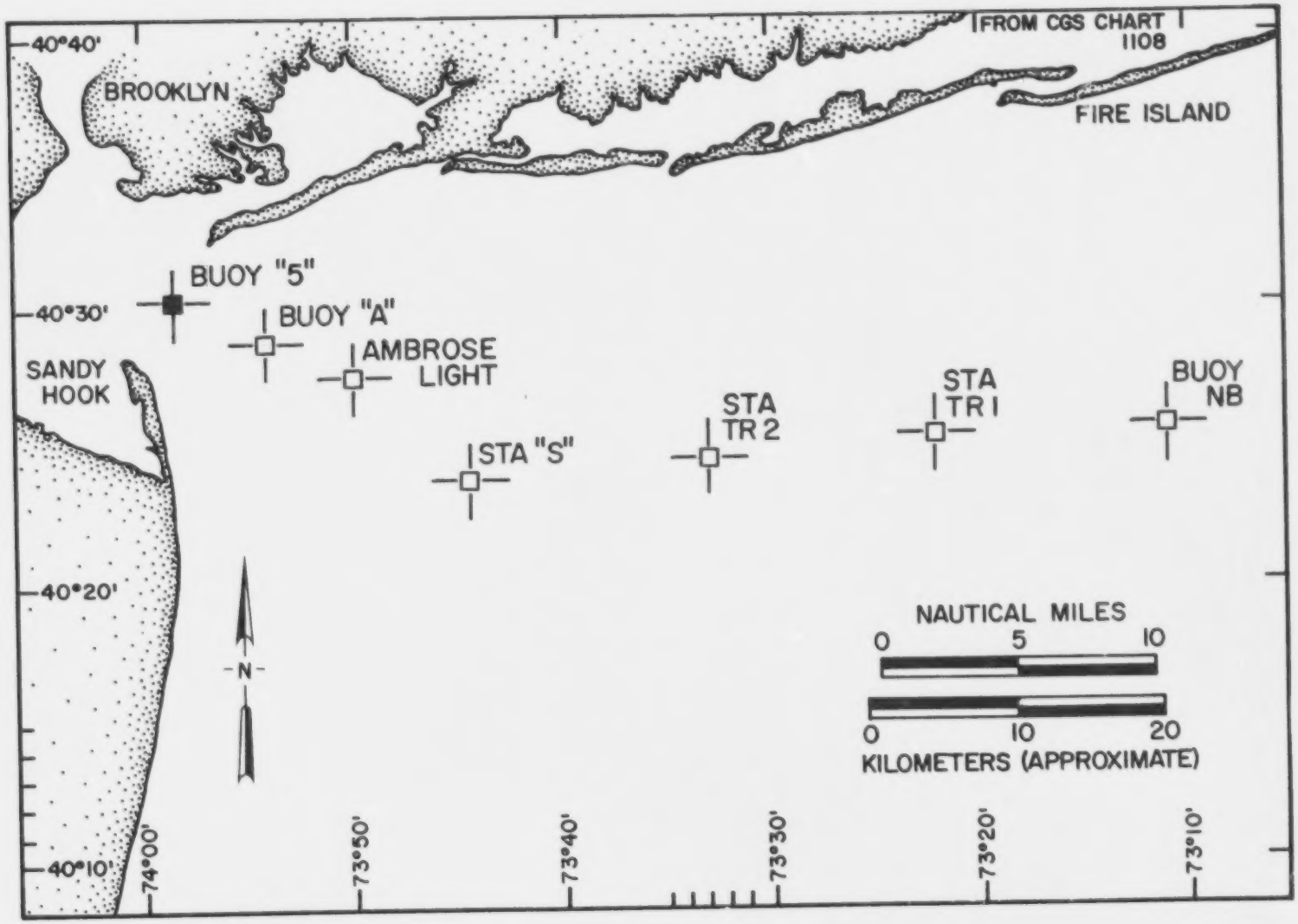

Figure 1. Sampling Locations in New York Bight

SECTION 2
TOTAL SUSPENDED MATTER (TSM) AT TRAVERSE STATIONS JUNE 1974 AND PRIOR CRUISES

The concentration and size distribution of TSM at various depths in the water column have been determined at several stations between New York Harbor, the present dump zone, and Buoy NB. Complete traverses were made through the area in February and March 1974, and again in June 1974. During other cruises, measurements were made at selected stations. Station locations and TSM concentration data are given in Appendix A. TSM data for the June 1974 cruise are also tabulated in Appendix B of this report, along with particle size and salinity data. Sampling and analytical procedures are discussed in the June-July 1974 cruise section of this report. Comparisons of these profiles with a model given by Schuble and Okubo (1974) are reported in Callaway et al. (1976).

SECTION 3
JUNE-JULY 1974 CRUISE

Objectives and Station Locations

The objective of this cruise was to develop observational techniques and to observe the wake discharge case. The Atlantic Twin, a twin-hull vessel of 28 meters overall length, was chartered for use from June 27 to July 2. Cruise participants were R. J. Callaway, field party chief, G. R. Ditsworth, A. M. Teeter, and A. G. Yartzoff, all of the U. S. Environmental Protection Agency, Corvallis, Oregon.

Samples and observations were taken in the wakes of vessels discharging sludge on June 27 and July 1. On June 30, stations were occupied on a traverse between Buoy "NB" and New York Harbor. Stations occupied, the time, latitude, longitude, and parameters attended at each station are given in Tables 1, 2, and 3. Each station identification is coded by the month, day, year, and sequence in which occupied (e.g., 070174-3 is identified as the third station occupied July 1, 1974).

On June 27, the New York City sludge vessel Newtown Creek was intercepted; radio contact was established and starting and finishing discharge times recorded. The Atlantic Twin was then positioned in the sludge wake (which was visible) and sampling began. A parachute drogue, set to about 3 m, was deployed to assist in tracking the waste field. Water samples for TSM analyses were collected, and light transmission was determined in the vertical. The field was sampled until it could no longer be detected by the transmissometer (percent light >85). It is possible that we lost track of the sewage field since the surface slick rapidly disappeared.

On July 1, the New York City sludge vessel Owls Head was intercepted in the dumping ground, and it discharged while underway. Drogues were deployed in the visible wake and sampling begun. TSM samples were taken. Transmittance profiles were made with an extinction transmissometer with a one-meter path length. Temperature-salinity profiles and current profiles were made to characterize ambient conditions and to compute the vertical diffusion coefficients which they infer. Sampling continued for about two hours after the discharge.

Navigation was performed with a Model 101 Decca radar set and Loran A. Fixes are good to about 450 m. The absolute position is not too important, as a Lagrangian experiment was indicated and we attempted to stay in the sewage field. Possible data interpretation errors relate to our inability to determine what part of the narrow sewage field we were in, i.e., a fictitious concentration decay with time might be due to sampling the borders of the field.

Sampling Procedures

Samples were collected at various depths throughout the water column for analysis of the TSM and to determine the salinity structure.

All samples, except those from the surface, were collected with 10-L Nisken samplers. Surface samples were dipped with a plastic bucket from near the stern of the vessel. Upon retrieval, a sample for salinity analysis was drawn into a 350-ml citrate bottle, after rinsing with the sample water. Immediately, the balance of the water sample, for TSM analyses, was emptied through the bottom closing valve into a sample-rinsed plastic bucket. In turn, a pre-rinsed, one-gallon Cubitainer® was filled. Seventy-five to 80 ml of Lugol's solution were then added. Samples were packaged and shipped to the EPA Laboratory at Corvallis, Oregon, for analyses.

Lugol's solution is a preservative and staining agent which causes less cell lysis than other preservatives (Carder and Schlemmer, 1973). It was prepared by dissolving 20 g of iodine and 40 g of potassium iodide in 300 ml of distilled water and then diluting to 2 L. The solution was filtered through a Millipore® 0.22 µm filter and stored in a covered, brown glass bottle until used.

Laboratory Analyses, Total Suspended Matter

General--

Upon receipt at the laboratory, each sample was well shaken to resuspend the particulate matter and a subsample of about 200 ml, for size analysis, was pipetted into a prerinsed 250 ml glass bottle. The remainder of each sample was stored in the Cubitainer® for subsequent gravimetric analysis. All samples were stored at room temperature during the analytical period, approximately two months overall, from the time of collection.

Size Analysis--

Size distributions of TSM were measured with a model T Coulter Counter®. This instrument electronically counts and sizes particles, suspended in an electrolyte, as they pass through a small orifice between two electrodes. It operates on the same principle as the Model B, for which Sheldon and Parsons (1967) have discussed marine research applications.

Samples were vigorously shaken by hand and then sonified for about one minute to disaggregate any floccules that may have formed during storage. Samples were normally introduced immediately into the instrument without further pretreatment, the seawater serving as the required electrolyte. Samples collected directly behind the disposal vessels were diluted with filtered electrolyte to obtain proper particle concentrations. Aperatures having diameters of 200 µm and 50 µm were used for analyses. Results of these analyses were combined to give a size distribution from about 1.5 µm to 80 µm, equivalent spherical diameter.

Concentration of Total Suspended Matter--

The concentration of TSM was determined gravimetrically, on a dry weight basis, by filtering measured volumes of samples through membrane filters having nominal pore diameters of 0.45 μm. A modification of the Banse et al., (1963) technique was used. Filters (Millapore® Type HA) were preconditioned by passing 100 ml of filtered distilled water through them, drying them at 90°C for at least one hour and weighing. Two blank control filters were treated with each batch of 10 filters to assess any inherent weight changes. Each sample was vigorously shaken and split into two approximately equal aliquots which were measured to ± 5 ml in 1000 ml graduates. Aliquots of 1.5 to 1.8 liters were normally used; however, to optimize filtration time, lesser volumes of those samples with high concentrations were used. Filters were washed with 10 to 15 ml of distilled water to remove salts, dried for at least one hour at 90°C and weighed. The net weights of the two filters were averaged to determine the concentration of particulate matter in mg/l. Results are given in Appendix B, Part II.

Caveats Regarding TSM Data--

Because of limited resources, it was not possible to accomplish analyses within a few hours of collection. Therefore, they were preserved, stored, and analyzed as laboratory schedules permitted.

Subsequent to the cruises reported herein comparative gravimetric analyses were done on 48 duplicate samples collected at the study site. One set of samples, left unpreserved, was filtered, immediately, on board the research vessel. Duplicates were preserved and shipped to Corvallis, Oregon, for analysis. The concentration of TSM in the preserved samples averaged 1.8 percent greater than, and ranged from 66 to 127 percent of, the concentration in unpreserved samples.

A more complex problem, as yet unresolved, is the representativeness of the size of particulate matter, measured with the Coulter Counter®, to the size of suspended matter, particularly the sludge, in the prototype. Project logistics precluded the use of the Coulter Counter® in the field; therefore, all size analyses were made on preserved samples which were shipped to Corvallis. Furthermore, particles sized by the Coulter Counter® appear to be relatively discrete, fine-grained material whereas sludge discharged into sea water may form into, and settle as, floccules.

During field experiments no *in situ*, underwater techniques were available to visually monitor the settling characteristics of sludge discharged from disposal vessels. Visual observations of laboratory settling tests suggest that a significant fraction of the sludge settles as floccules which may be a few millimeters in diameter. Because of their fragile nature, attempts to sample the floccules caused them to break into finer particles. It is assumed that similar circumstances occurred in the field, resulting in samples with much fine-grained material which was then sized and found to have mean sizes on the order of a few micrometers. The size of particles measured may not, in fact, represent the size of particles or floccules that are actually settling. These data should therefore be used with discretion in studies of

the settling and dispersion of sludge that is discharged from the disposal vessels.

Laboratory Analyses, Salinity

Salinity analyses were done at the Corvallis, Oregon, Environmental Protection Agency laboratories with a Hytech® model 6220 laboratory salinometer. Values are tabulated in Appendix B, Part II.

SECTION 4
DECEMBER 1974 CRUISE

Objectives, Station Locations, and Field Observations

The second survey to sample sludge wastes was conducted from December 18 to December 21. The Atlantic Twin was again chartered. Participants were R. J. Callaway, field party chief, G. R. Ditsworth, A. M. Teeter, and D. W. Brown. Arrangements were made with the New York City Environmental Protection Administration to have their sludge vessels enter the dumping ground as usual, but to unload the wastes at a stop, rather than while underway. Sludge samples were obtained from the vessel prior to departure. Sampling locations and parameters attended are given in Tables 4, 5, and 6.

Before the sludge vessel arrived in the dumping ground, background samples were obtained in the vertical for temperature, salinity, TSM and light transmission. TSM samples were collected with 10-L Niskin water samplers; salinity, temperature, and light transmission data were obtained with an Interocean® Model 513 salinity, temperature, and depth instrument (STD). On December 18, the vessel Newtown Creek was in radio contact with us and established the start and stop times of discharge, which took six minutes. The discharge was not at a complete halt because of tides and winds to 25 knots; the initial patch size was about 50-75 m in diameter.

After the Newtown Creek moved out, the Atlantic Twin backed in and remained stern to the discharge patch for the duration of the sampling. The patch was easily discerned by its color and surface slick.

Once in the patch, the STD was lowered; this set the TSM sampling interval which was used almost exclusively; 0, 5, 10, 15, and 20 m. The STD visual records for the first few rounds were extremely erratic, but the trend could be detected. The trouble was due to slip ring problems in the electric winch. The transducer was then raised and lowered by hand and the problem disappeared.

During the first day of sampling, the wind action was strong enough to completely mix the water column; temperature and salinity showed very little gradient. Light transmission also showed little gradient, being about 90 percent (before dumping). After dumping, the most significant change was, of course, in percent of light transmission. Rather good records were made of this event in conjunction with the density profile (via T, S,). On the second day of sampling the winds lessened and a double mixed layer developed which strengthened late in the day. A moored current meter was deployed for the remainder of the cruise, measuring currents at 2.5 meters depth. A similar sampling scheme was followed again on the second and third day of the December cruise. Temperature, salinity, and light transmission data are given in Teeter et al. (1975).

Collection and Analyses of TSM Samples

Sample collection and size analysis procedures are given in the June-July, 1974 Cruise Section of this report. Gravimetric analyses were modified to utilize membrane filters made from polyvinyl chloride (Millipore® Type BD) which were found to have smaller and more uniform inherent weight losses than cellulose-base filters (Millipore® Type HA). Filtration tests were done with prefiltered water which passed the filters rapidly. Unfortunately it was later discovered that the PVC filters were severely leached as a function of their exposure time to sea water. Filtering times for the TSM samples ranged from several minutes to a few hours. These times were not recorded, therefore, it was not possible to reliably estimate the weight loss for each filter. Because of this unknown factor the entire set of gravimetric data are considered unreliable and are not reported.

Table 1. NEW YORK BIGHT: STATIONS IN WAKE OF DISPOSAL VESSEL NEWTOWN CREEK, JUNE 27, 1974

Station*	Time** Begin	Time** End	Latitude	Longitude	Parameter***
062774-1	1000	1040	40°27.4'N	73°44.8'W	CM,TS,TSM,S
062774-2	1045	1055	40°25.3'N	73°45.5'W	TSM, S
062774-3	1104	1133	40°26.4'N	73°44.8'W	CM, TSM
062774-4	1215	1237	40°26.4'N	73°46.2'W	CM, TSM
062774-5	1313	1330	40°27.4'N	73°47.1'W	CM, TSM

* Station identification explained in Part II of Appendix B
** Eastern Daylight Time

*** Parameter Codes
CM Current meter observation
TS In Situ temperature-salinity profile
TSM Total suspended matter sample
S Salinity sample

Table 2. NEW YORK BIGHT: TRAVERSE STATIONS BUOY NB-NEW YORK HARBOR, JUNE 30, 1974

Station*	Time** Begin	Time** End	Latitude	Longitude	Parameter***
063074-1	1136	1210	40°25.7'N	73°11.5'W	TSM,S,K
063074-2	1420	1510	40°25.2'N	73°22.0'W	TS,TSM,S,K
063074-3	1620	1710	40°24.5'N	73°32.9'W	TSM,S,K
060374-4	1845	1915	40°23.8'N	73°44.4'W	TS,TSM,S
063074-5	2020	2045	40°26.9'N	73°48.8'W	TSM,S
063074-6	2125	2135	40°28.8'N	73°53.7'W	TS,TSM,S
063074-7	2230	2240	40°30.5'N	73°58.6'W	TSM,S

* Station identification explained in Part II of Appendix B
** Eastern Daylight Time

*** Parameter Codes
TS In Situ temperature-salinity profile
TSM Total suspended matter sample
S Salinity sample
K Transmissometer profile

Table 3. NEW YORK BIGHT: STATIONS IN WAKE OF DISPOSAL VESSEL OWLS HEAD, JULY 1, 1974

Station*	Time** Begin	Time** End	Latitude	Longitude	Parameter***
070174-1	1015	1110	40°25.4'N	73°44.6'W	CM,TS,TSM,K,D
070174-2	1120	1200	40°25.4'N	73°43.9'W	TSM,K
070174-3	1220	1300	40°26.5'N	73°43.2'W	CM,TSM,K
070174-4	1400	1420	40°27.4'N	73°49.8'W	TSM,K
070174-5	1523	1530	40°28.8'N	73°53.7'W	K

* Station identification explained in Part II of Appendix B
** Eastern Daylight Time

*** Parameter Codes
CM Current meter profile
TS In Situ temperature-salinity profile
TSM Total suspended matter sample
K Transmissometer profile
D Drift cards deployed

Table 4. NEW YORK BIGHT: STATIONS IN WAKE OF DISPOSAL VESSEL NEWTOWN CREEK, DECEMBER 18, 1974

Station*	Time** Begin	Time** End	Latitude	Longitude	Parameter***
121874-1	0750	0850	40°24.9'N	73°44.8'W	X
121874-2	0946	1100	40°24.9'N	73°44.8'W	4X
121874-3	1110	1202	40°25.8'N	73°44.3'W	TSM,2X
121874-4	1230	1301	40°24.6'N	73°43.8'W	TSM,2X
121874-5	1328	1355	40°24.4'N	73°41.7'W	TSM,X
121874-6	1412	1420	40°24.2'N	73°44.8'W	X

* Station identification explained in Part II of Appendix B
** Eastern Standard Time

*** Parameter Codes
TSM Total suspended matter sample
X STD profile; 2X, 4X etc. equal profiles done at given station

Table 5. NEW YORK BIGHT: STATIONS IN WAKE OF DISPOSAL VESSEL NEWTOWN CREEK, DECEMBER 19, 1974

Station*	Time** Begin	Time** End	Latitude	Longitude	Parameter***
121974-1	0842	0955	40°24.7'N	73°44.7'W	TSM,2X
121974-2	1235	1256	40°24.7'N	73°44.7'W	TSM,3X
121974-3	1323	1409	40°24.7'N	73°44.1'W	TSM,3X
121974-4	1430	1502	40°25.3'N	73°42.7'W	TSM,2X
121974-5	1529	1540	40°25.0'N	73°41.7'W	TSM,X
121974-6	1600	1602	40°25.7'N	73°45.3'W	X

* Station identification explained in Part II of Appendix B
** Eastern Standard Time

*** Parameter Codes
TSM Total suspended matter sample
X STD profile; 2X, 4X etc. equal profiles done at given station

Table 6. NEW YORK BIGHT: STATIONS IN WAKE OF DISPOSAL VESSEL NEWTOWN CREEK, DECEMBER 20, 1974

Station*	Time** Begin	Time** End	Latitude	Longitude	Parameter***
122074-1	1007	1010	40°24.7'N	72°44.7'W	TSM,X
122074-2	1020	1043	40°24.7'N	73°44.7'W	TSM,2X
122074-3	1117	1153	40°24.1'N	73°44.9'W	3X
122074-4	1232	1232	40°23.8'N	73°45.0'W[a]	X

* Station identification explained in Part II of Appendix B
** Eastern Standard Time
a Not located by navigation; position estimated from drift between 122074-2 and 122074-3

*** Parameter Codes
TSM Total suspended matter sample
X STD profile; 2X, 3X etc. equal profiles done at given station

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APPENDIX A
TOTAL SUSPENDED MATTER AT TRAVERSE STATIONS: JUNE-JULY, 1974 AND PRIOR CRUISES

Discussion of Appendix Format

Tables A-1 through A-7 give the concentration of total suspended matter in milligrams per liter, dry weight basis, at various depths in the water column at stations sampled from August 1973 through June, 1974. Note that all stations were not sampled during each cruise nor were samples collected from the same depths each time.

Figure A-1	Traverse Station Locations
A-2	Vertical Profile TSM Concentration (mg/l) Feb.-Mar. 1974
A-3	Vertical Profile TSM Concentration (mg/l) June 1974
Table A-1	Station, vicinity buoy "5", Ambrose Channel
A-2	Station, vicinity buoy "A", Ambrose Channel
A-3	Station, vicinity Ambrose Light
A-4	Station in Dump Zone
A-5	Station, vicinity TR-2
A-6	Station, vicinity TR-1
A-7	Station, vicinity buoy "NB"

Table A-1. NEW YORK BIGHT: STATION, VICINITY BUOY "5", AMBORSE CHANNEL: LATITUDE 40° 30.5'N, LONGITUDE 73° 58.6'W: TOTAL SUSPENDED MATTER, Mg/L

Depth Meters	Cruise Mo/Yr.		
	8/73	2/74	6/74
0	1.0	4.8	3.2
2	---	6.0	3.1
5	---	5.6	2.6
6	1.6	---	---
12	4.6	---	---

Table A-2. NEW YORK BIGHT: STATION, VICINITY BUOY "A", AMBROSE CHANNEL: LATITUDE 40° 28.8'N LONGITUDE 73° 53.7'W: TOTAL SUSPENDED MATTER, Mg/L

Depth Meters	Cruise Mo/Yr.		
	8/73	2/74	6/74
0	1.3	1.2	1.9
5	---	1.1	1.5
8	2.6	---	---
10	---	2.4	2.0
15	4.4	---	---

Table A-3 NEW YORK BIGHT: STATION, VICINITY AMBROSE LIGHT: LATITUDE 40° 27.4'N, LONGITUDE 73° 49.8'W: TOTAL SUSPENDED MATTER, Mg/L

Depth Meters	Cruise Mo/Yr.				
	8/73	2/74	5/74	6/74	7/74*
0	2.5	1.0	---	2.7	2.3
3	---	---	---	---	2.7
5	---	0.7	---	2.4	3.2
10	---	0.9	1.4	1.1	1.9
12	1.0	---	---	---	---
15	---	1.0	---	---	---
20	---	0.9	1.2	1.0	0.7
24	3.9	---	---	---	---
25	---	---	1.7	1.6	---

* Occupied July 1, 1974; the only traverse station occupied in July, 1974

Table A-4. NEW YORK BIGHT: STATION IN DUMP ZONE: LATITUDE 40° 23.8'N, LONGITUDE 73° 44.4'W: TOTAL SUSPENDED MATTER, Mg/L

Depth Meters	Cruise Mo/Yr.					
	8/73	12/73	2/74	3/74	5/74	6/74
0	0.7	0.8	1.5	2.0	1.0	2.2
5	---	---	---	---	1.0	2.4
7	---	0.9	---	---	---	---
10	---	---	1.4	1.3	1.0	1.9
12	0.3	---	---	---	---	---
14	---	0.8	---	---	---	---
15	---	---	1.2	---	---	---
20	---	---	0.9	0.8	1.0	1.0
21	---	1.2	---	---	---	---
23	---	---	0.9	0.8	---	---
24	0.7	---	---	---	---	1.2
28	---	1.2	---	---	---	---

Table A-5. NEW YORK BIGHT: STATION, VICINITY TR-2; LATITUDE 40° 24.5'N, LONGITUDE 73° 32.9'W: TOTAL SUSPENDED MATTER, Mg/L

Depth Meters	Cruise Mo/Yr		
	3/74	5/74	6/74
0	0.8	1.0	1.1
5	---	---	0.8
10	0.9	0.8	1.0
15	---	1.0	---
20	1.1	1.2	0.6
23	1.3	---	---
25	---	---	0.7

Table A-6. NEW YORK BIGHT: STATION, VICINITY TR-1; LATITUDE 40° 25.2'N, LONGITUDE 73° 22.0'W: TOTAL SUSPENDED MATTER, Mg/L

Depth Meters	Cruise Mo/Yr		
	3/74	5/74	6/74
0	0.9	1.0	0.6
5	---	---	0.7
10	0.8	0.8	0.8
20	0.8	0.7	0.6
25	0.8	1.6	---
28	0.9	1.4	0.7

Table A-7. NEW YORK BIGHT: STATION, VICINITY BUOY "NB"; LATITUDE 40° 25.7'N, LONGITUDE 73° 11.5'W: TOTAL SUSPENDED MATTER, Mg/L

Depth Meters	Cruise Mo/Yr					
	8/73	12/73	2/74	3/74	5/74	6/74
0	0.1	1.2	0.9	1.0	0.3	0.5
5	---	---	---	---	---	0.5
8	---	1.1	---	---	---	---
10	---	---	0.9	1.2	0.5	0.6
15	0.3	---	---	---	---	---
16	---	1.1	---	---	---	---
20	---	---	1.0	0.7	0.5	0.5
24	---	1.0	---	---	---	---
25	---	---	1.0	1.0	1.0	---
28	---	---	0.9	---	1.3	---
30	0.8	---	---	1.2	---	0.6
33	---	0.9	---	---	---	---

APPENDIX B
JUNE-JULY, 1974 CRUISE

Part I Introduction and information included.

Part II Tabulated salinity and total suspended matter data.

Discussion of Table headings

Table B-1. Wake of Disposal Vessel Newtown Creek, June 27, 1974

Table B-2. Traverse, Buoy NB to New York Harbor, June 30, 1974.

Table B-3. Wake of Disposal Vessel Owls Head, July 1, 1974.

Part III Profiles of temperature, salinity, density, light transmittance and currents.

Discussion of contents

Parameters and Symbols

Figure B-1 Station 062774-1, 1000 EDT; Salinity, Temperature, and Sigma-t vs Depth

Figure B-2 Station 063074-1, 1210 EDT: Transmittance vs Depth

Figure B-3 Station 063074-2, 1440 EDT: Transmittance vs Depth

Figure B-4 Station 063074-2, 1440 EDT; Salinity, Temperature, and Sigma-t vs Depth

Figure B-5 Station 063074-3, 1620 EDT; Transmittance vs Depth.

Figure B-6 Station 063074-4, 1845 EDT; Salinity, Temperature and Sigma-t vs Depth.

Figure B-7 Station 063074-6, 2136 EDT; Salinity, Temperature and Sigma-t vs Depth.

Figure B-8 Station 070174-1, 1024 EDT; Salinity, Temperature, and Sigma-t vs Depth.

Figure B-9 Station 070174-1, 1053 EDT; Transmittance vs Depth

Figure B-10 Station 070174-2, 1133 EDT; Transmittance vs Depth

Figure B-11 Station 070174-3, 1220 EDT; Salinity, Temperature, and Sigma-t vs Depth.

Figure B-12 Station 070174-3, 1235 EDT; Transmittance vs Depth

Figure B-13 Station 070174-4, 1355 EDT; Transmittance vs Depth

Figure B-14 Station 070174-5, 1511 EDT; Transmittance vs Depth

Table B-4 Station 062774-1, 1032 EDT; Current Profile

Table B-5 Station 062774-3, 1127 EDT; Current Profile

Table B-6 Station 062774-4, 1237 EDT; Current Profile

Table B-7 Station 062774-5, 1325 EDT; Current Profile

Table B-8 Station 070174-1, 1105 EDT; Current Profile

Table B-9 Station 070174-3, 1220 EDT; Current Profile

Part IV Total suspended matter; size analyses; examples of detailed tables and graphs.

Discussion and explanation of table and graph headings.

Figure B-15 Example of tabulated data

Figure B-16 Example of size frequency curve

Part V Tables cross-referencing station identification and particle size sample designations.

Explanation of Tables

Table B-10 Cross Reference of Total Suspended Matter Sample Identification versus Standard Station Identification: Wake of Vessel Newtown Creek, June 27, 1974.

Table B-11 Cross Reference of Total Suspended Matter Identification versus Standard Station Identification: Traverse, Buoy NB-New York Harbor, June 30, 1974.

Table B-12 Cross Reference of Total Suspended Matter Sample Identification versus Standard Station Identification: Wake of Vessel; Owls Head, July 1, 1974.

Table B-13 Conversion of Equivalent Diameters in millimeters to Particle Diameters in Phi Notation.

PART I, APPENDIX B
Introduction and Information Included

Information presented in this appendix was obtained between June 27 and July 1, 1974 from observations made in the wakes of disposal vessels discharging sludge in the present dump zone and from observations along a traverse between buoy "NB" and New York Harbor. Part II has tabulated station information and data for salinity and total suspended matter. In Part III are a series of profiles from *in situ* instrumental measurements. Included is information on salinity, temperature, currents, and light transmission. Examples of detailed size analysis data are given in Part IV; Part V cross-references station identifications and particle size sample designations used in this report.

PART II, APPENDIX B
Tabulated Salinity and Total Suspended Matter Data

Discussion of Table Headings

Salinity and total suspended matter (TSM) data collected on June 27, June 30, and July 1, 1974, are given in Tables B-1, B-2, and B-3 respectively.

Column headings of the tables are:

Station: The station identification consists of seven numerals which identifies the month, day, year, and daily station sequence e.g., station 062774-3.

06 = month = June
27 = day of month
74 = year
3 = 3rd station occupied June 27, 1974

Latitude: Latitude of station, °N.

Longitude: Longitude of station, °W.

Time: The time span during which the station was occupied is given in Eastern Daylight Time.

Salinity, PPT: Salinity of water sample collected at station and depth given; reported to 0.01 part per thousand (PPT).

Total Suspended Matter: Several subheadings are included under this heading that relate to the size, size frequency distribution and concentration of total suspended matter.

Particle Size Data: Two subheadings are given relating to particle size analyses.

Mean Size, Equivalent Diameter: Size analyses of the TSM were determined with a Coulter Counter® which measures particle volume. Data are presented in the more conventional terms of particle diameter which is the equivalent diameter of a sphere which has a volume of that measured. Diameters are indicated by two measures:

μm: the equivalent diameter in micrometers

Ø: Phi is a logrithmic transformation which permits plotting of a geometric scale on a linear scale [$Ø = -\log_2 E$ (E equals particle diameter in millimeters, Krumbein and Pettijohn, 1936)].

Standard Deviation, Phi Units: The standard deviation of the size frequency distribution curve in phi units.

Concentration mg/L: The concentration of total suspended matter, dry weight, in milligrams per liter.

Table B-1. NEW YORK BIGHT: WAKE OF DISPOSAL VESSEL NEWTOWN CREEK; JUNE 27, 1974

Station	Latitude	Longitude	Time EDT	Depth Meters	Salinity PPT	Total Suspended Matter Particle Size Data Mean Size Equivalent Diameter µM	Mean Size Diameter Ø	Standard Deviation Phi Units	Conc. mg/L
062774-1	40°27.4'N	73°44.8'W	1000	0	30.52	9.3	6.75	1.27	1.3
			1040	5	30.76	13.3	6.23	1.27	8.1
				10	31.02	12.5	6.32	1.29	4.3
				15	31.11	13.5	6.21	1.39	1.4
				20	31.14	14.7	6.09	1.54	0.9
062774-2	40°25.3'N	73°45.5'W	1045	0	30.73	9.6	6.71	1.34	1.0
			1055	5	30.73	12.1	6.37	1.50	1.1
				10	30.94	13.7	6.19	1.59	1.0
				15	31.09	14.4	6.12	1.53	0.8
				20	31.05	14.1	6.15	1.55	0.8
062774-3	40°26.2'N	73°44.8'W	1104	0	----	14.5	6.11	1.51	0.9
			1133	5	-----	9.4	6.74	1.30	1.0
				10	-----	10.8	6.53	1.42	1.0
				15	-----	15.3	6.03	1.53	0.8
				20	-----	19.2	5.70	1.67	1.0
062774-4	40°26.4'N	73°46.2'W	1215	0	-----	14.3	6.13	1.62	1.1
			1237	5	-----	17.2	5.86	1.64	1.0
				10	-----	12.7	6.30	1.62	0.9
				15	-----	14.5	6.11	1.55	0.8
				20	-----	17.8	5.81	1.54	0.5
				25	-----	10.4	6.58	1.52	0.7

(Table B-1 cont.)

Station	Latitude	Longitude	Time EDT	Depth Meters	Salinity PPT	Total Suspended Matter Particle Size Data Mean Size Equivalent Diameter µM	Mean Size Diameter Ø	Standard Deviation Phi Units	Conc. mg/L
062774-5	40°27.4'N	73°47.1'W	1313	0	-----	10.2	6.62	1.36	1.2
			1330	5	-----	13.8	6.18	1.58	0.9
				10	-----	13.8	6.18	1.52	1.0
				15	-----	13.9	6.17	1.52	0.8
				20	-----	13.9	6.17	1.52	0.8
				25	-----	16.8	5.90	1.59	0.9

Table B-2. NEW YORK BIGHT: TRAVERSE; BUOY "NB" - NEW YORK HARBOR; JUNE 30, 1974

Station	Latitude	Longitude	Time EDT	Depth Meters	Salinity PPT	Total Suspended Matter Particle Size Data Mean Size Equivalent Diameter µM	Mean Size Diameter Ø	Standard Deviation Phi Units	Conc. mg/L
063074-1	40°27.5'N	73°11.5'W	1136	0	31.43	9.4	6.73	1.29	0.5
			1210	5	31.44	7.3	7.09	1.19	0.5
				10	31.55	14.3	6.13	1.48	0.6
				20	31.70	14.1	6.15	1.48	0.4
				30	31.71	12.3	6.34	1.42	0.6
063074-2	40°25.2'N	73°22.0'W	1420	0	30.81	9.3	6.75	1.35	0.6
			1510	5	30.81	9.8	6.67	1.21	0.7
				10	31.60	13.0	6.27	1.49	0.8
				20	31.66	12.0	6.38	1.43	0.5
				28	31.68	9.5	6.72	1.43	0.7
06307-3	40°24.5'N	73°32.9'W	1620	0	31.25	14.4	6.12	1.44	1.1
			1710	5	31.26	15.6	6.00	1.47	0.8
				10	31.26	16.9	5.89	1.44	1.0
				20	31.34	15.8	5.98	1.41	0.6
				35	31.27	14.1	6.15	1.48	0.7

(Table B-2 cont.)

Station	Latitude	Longitude	Time EDT	Depth Meters	Salinity PPT	Total Suspended Matter Particle Size Data Mean Size Equivalent µM	Mean Size Diameter Ø	Standard Deviation Phi Units	Conc. mg/L
063074-4	40°23.8'N	73°44.4'W	1845	0	329.94	8.4	6.74	1.25	2.2
			1915	5	30.05	8.5	6.88	1.23	2.4
				10	31.74	15.4	6.02	1.46	1.9
				20	31.41	8.4	6.89	1.26	1.0
				24	31.43	10.4	6.59	1.52	1.2
063074-5	40°26.9'N	73°48.8'W	2020	0	29.25	8.1	6.95	1.15	2.7
			2045	5	30.08	8.2	6.93	1.19	2.4
				10	31.12	7.1	7.14	1.37	1.1
				20	31.22	9.0	6.80	1.43	1.0
				25	31.38	6.7	7.22	1.37	1.6
063074-6	40°28.8'N	73°53.7'W	2125	0	27.24	9.0	6.80	1.26	1.9
			2135	5	30.63	8.3	6.92	1.44	1.5
				10	30.92	7.8	7.00	1.38	1.9
063074-7	40°30.5'N	73°58.6'W	2230	0	26.25	6.1	7.35	1.28	3.2
			2240	2.5	26.17	6.2	7.33	1.32	3.1
				5	27.41	5.9	7.40	1.37	2.6

Table B-3. NEW YORK BIGHT: WAKE OF DISPOSAL VESSEL OWLS HEAD; JULY 1, 1974

Station	Latitude	Longitude	Time EDT	Depth Meters	Salinity PPT	Total Suspended Matter Particle Size Data: Mean Size Equivalent µM	Mean Size Diameter Ø	Standard Deviation Phi Units	Conc. mg/L
070174-1	40°25.4'N	73°44.6'W	1015	0	-----	8.1	6.95	1.27	2.8
			1110	5	-----	9.8	6.67	1.46	1.7
				10	-----	20.0	5.64	1.55	1.5
				20	-----	14.7	6.09	1.52	1.1
				24	-----	11.0	6.50	1.36	1.4
070174-2	40°25.4'N	73°43.9'W	1120	0	-----	7.5	7.06	0.99	2.6
			1200	4	-----	8.6	6.86	1.36	2.5
				15	-----	22.1	5.50	1.42	1.0
				20	-----	12.9	6.28	1.53	1.5
				24	-----	9.0	6.80	1.38	1.4
070174-3	40°26.5'N	73°43.2'W	1220	0	-----	8.0	6.96	1.04	2.4
			1300	3	-----	8.6	6.87	1.13	2.1
				5	-----	11.0	6.50	1.41	2.4
				10	-----	11.4	6.45	1.42	0.7
				24	-----	10.8	6.54	1.47	0.9
070174-4	40°27.4'N	73°49.8'W	1400	0	-----	7.3	7.10	0.85	2.3
			1420	3	-----	10.4	6.59	1.29	3.7
				5	-----	10.4	6.58	1.28	3.2
				10	-----	12.0	6.38	1.52	1.9
				20	-----	7.6	7.03	1.41	0.7

PART III, APPENDIX B
Profiles of Temperature, Salinity, Density, Light Transmittance, and Currents

Discussion of Contents

Figures and tables in this part of Appendix B represent processed data from temperature-salinity profiles, light transmittance profiles, and current profiles. Figures and tables are arranged sequentially by date and station for the three days of the cruise. All times are referenced to Eastern Daylight Time (EDT).

The salinity and temperature profiles consist of a listing of each datum point for which the depth has been corrected for wire angle. Salinity values were recalculated from conductivity and temperature readings taken with a Beckman® RS5-3 salinometer because they agreed more closely with salinity values measured with a Plessey Model 6220 laboratory salinometer than did the values measured directly from the RS5-3.

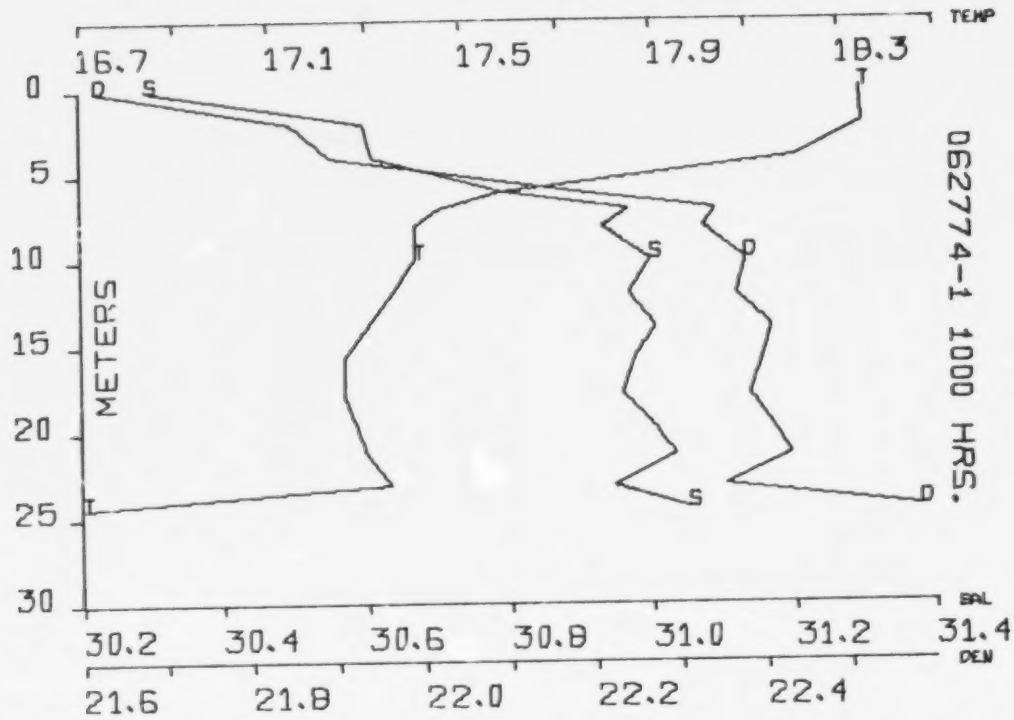
Current meter profiles were taken with a Hydro Products® Model 460A/465A instrument. Data are listed by corrected depth and are appropriately corrected for vessel drift and magnetic variation. Profiles of light transmittance taken with a Bendix® Model C_2S_4 Alpha Meter are listed by corrected depths along the computed extinction coefficients, Alpha (A). As noted in Teeter et al. (1975) of this report the useful range of Alpha, for this instrument, is from 0.1 M^{-1} to 3.5 M^{-1}. Values within this range are given in this appendix.

Detailed descriptions of the instrumentation, field procedures and data processing are given in Teeter et al. (1975).

Parameters and Symbols

Depth (M)	Labeled METERS on the graph ordinate; the depth of observation.
Salinity (PPT)	Labeled SAL on the abscissa of graphs; labeled S on the graph profiles. Salinity is a measure of the dissolved salts in sea water and is reported in parts per thousand.
Temperature (C)	Labeled TEMP on the abscissa of graphs; labeled T on the graph profiles. The temperature in degrees Celsius.

Sigma-t	Labeled DEN on the abscissa of graphs; labeled D on the graph profiles. Sigma-t is a convenient means of expressing the density of sea water; it is related to the density by the equation: sigma-t = (D-1)(1000), where D is the density of the water parcel.
%T	The percent light transmittance. It is labeled %TR on abscissa and P on profiles. The percent transmittance is the ratio of the intensity of a light beam incident on a photoelectric cell one meter from the light source to the intensity of the same beam incident on a reference photoelectric cell.
A m^{-1}	Alpha per meter; labeled ALPH on abscissa; labeled A on the profile. Alpha, a measure of light attenuation is related to the percent transmission by $(-\frac{1}{d} \ln T)$ where d is the light path length and T is the percent transmittance.
Speed, Kts	Current speed in knots. A knot, one nautical mile per hour equals 51.44 cm sec^{-1}.
Direction, °T	Current direction referenced to geographic or true north.



Depth (M)	Salinity (PPT)	Temperature (c)	Sigma-T
0	30.29	18.34	21.62
2.0	30.60	18.35	21.85
4.0	30.61	18.20	21.89
6.0	30.79	17.58	22.18
7.0	30.96	17.45	22.34
8.0	30.93	17.40	22.32
9.9	30.99	17.40	22.38
11.9	30.96	17.35	22.36
13.8	31.00	17.30	22.40
15.7	30.97	17.25	22.39
17.7	30.95	17.25	22.38
19.6	31.00	17.28	22.41
21.3	31.03	17.30	22.43
23.1	30.94	17.35	22.35
24.4	31.05	16.70	22.58

Figure B-1 Station 062774-1, 1000 EDT; Salinity, Temperature, and Sigma-t vs Depth

Table B-4. STATION 062774-1, 1032 EDT; CURRENT PROFILE

Depth, M.	Resolved Currents Speed, Kts	Direction °T
0.8	0.57	352
3.8	0.26	025
6.9	0.25	328
9.9	0.17	318
13.0	0.17	276
16.0	0.17	276
19.0	0.16	273
22.1	0.15	299
25.1	0.11	311

Table B-5. STATION 062774-3, 1127 EDT; CURRENT PROFILE

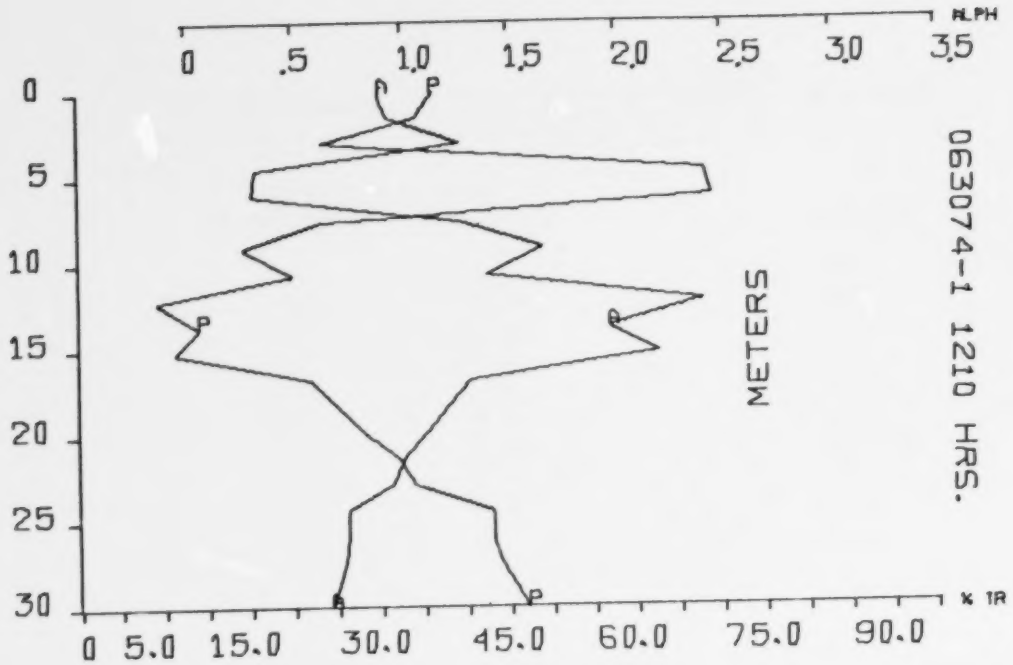
Depth, M.	Resolved Currents Speed Kts	Direction °T
0.8	0.69	359
3.8	0.51	349
6.9	0.53	339
9.9	0.60	315
13.0	0.86	300
16.0	0.92	295
19.0	0.85	328
22.1	0.69	299
25.1	0.26	348

Table B-6. STATION 062774-4, 1237 EDT; CURRENT PROFILE

Depth, M.	Resolved Currents Speed, Kts	Direction °T
0.8	0.92	306
3.8	0.95	298
6.9	1.10	289
9.9	1.09	292
13.0	1.17	304
16.0	0.95	309
19.0	0.57	315
22.1	0.37	331
24.4	0.22	022

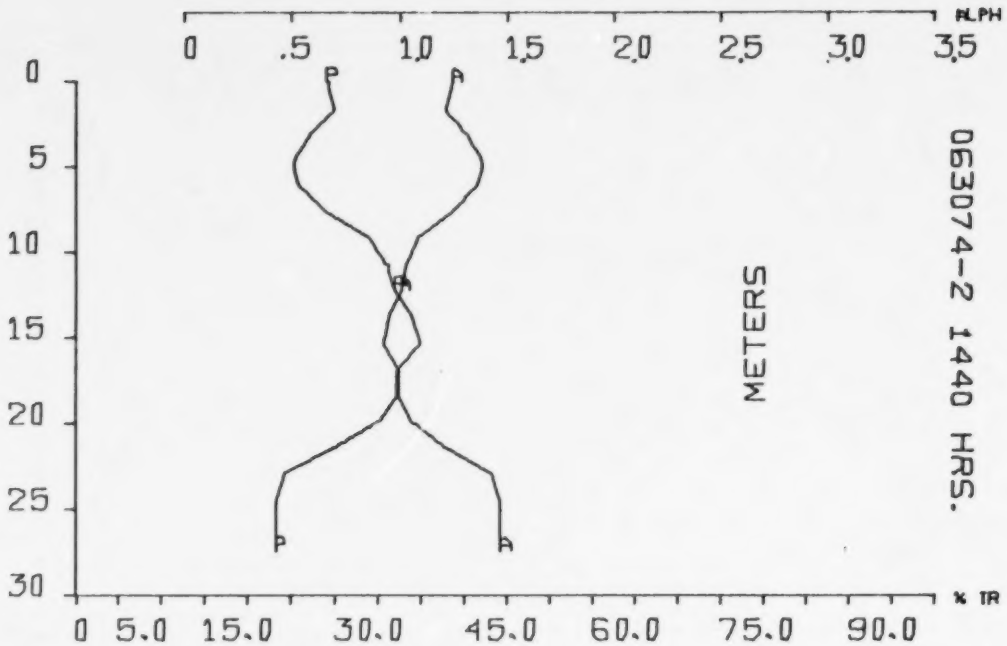
Table B-7. STATION 062774-5, 1325 EDT; CURRENT PROFILE

Depth, M.	Resolved Currents Speed, Kts	Direction °T
0.8	0.23	354
3.8	0.39	059
6.9	0.09	166
9.9	0.22	215
13.0	0.33	229
16.0	0.34	251
19.0	0.30	246
22.1	0.36	235
25.1	0.26	255



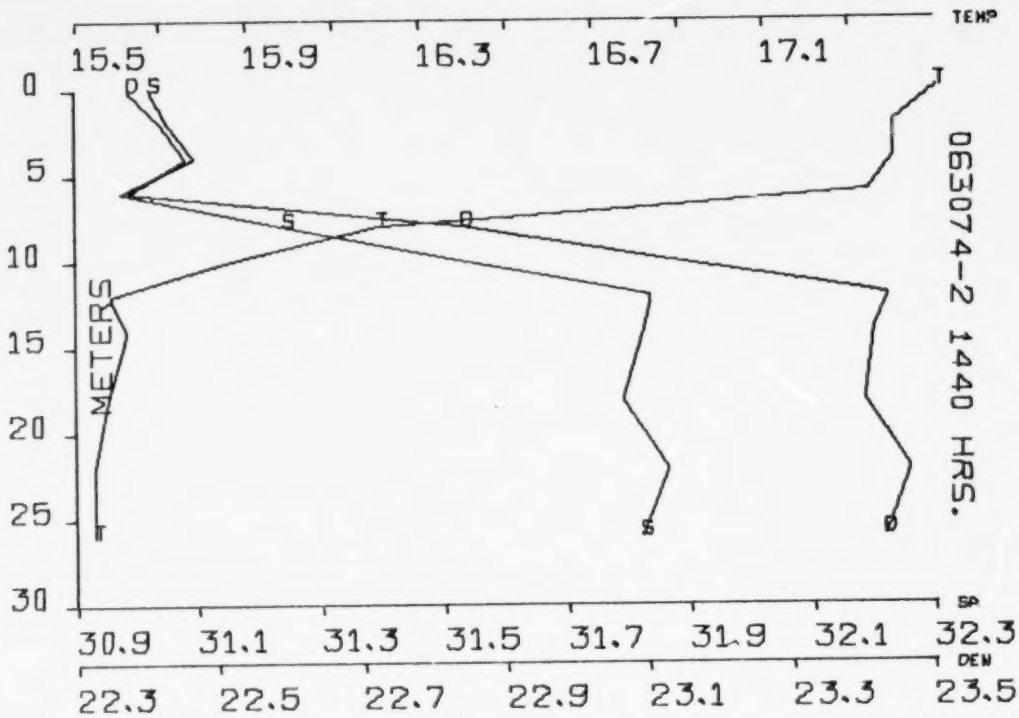
Depth, M	% T	A, m^{-1}
0	41	.89
1.5	39	.94
3.0	28	1.27
4.6	73	.31
6.1	74	.30
7.6	28	1.27
9.1	19	1.66
10.7	25	1.38
12.2	9	2.41
13.7	14	1.97
15.2	11	2.21
16.8	27	1.31
18.3	30	1.20
19.8	33	1.11
21.3	37	.99
22.9	39	.94
24.4	48	.73
25.9	48	.73
27.4	49	.71
30.0	52	.65

Figure B-2 Station 063074-1, 1210 EDT: Transmittance vs Depth



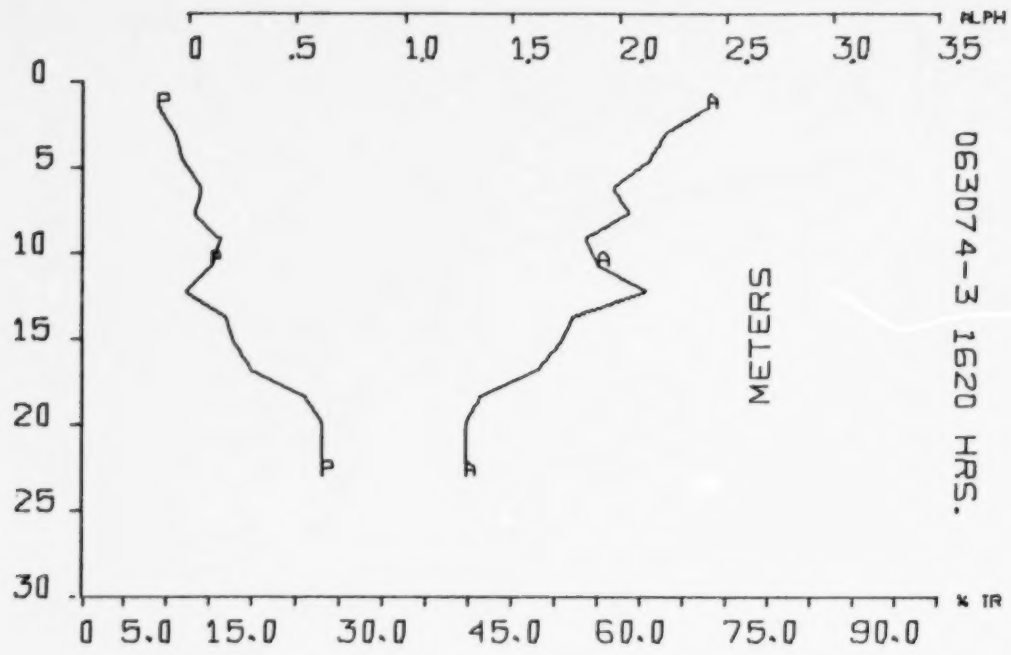
Depth, M	% T	A, m^{-1}
0	29	1.24
1.5	30	1.20
3.0	27	1.31
4.6	25	1.38
6.1	26	1.35
7.6	29	1.24
9.1	34	1.08
10.7	36	1.02
12.2	37	.99
13.7	39	.94
15.2	40	.92
16.8	37	.99
18.3	37	.99
19.8	35	1.05
21.3	30	1.20
22.9	24	1.43
24.4	23	1.47
25.9	23	1.47
27.4	23	1.47

Figure B-3 Station 063074-2, 1440 EDT: Transmittance vs Depth



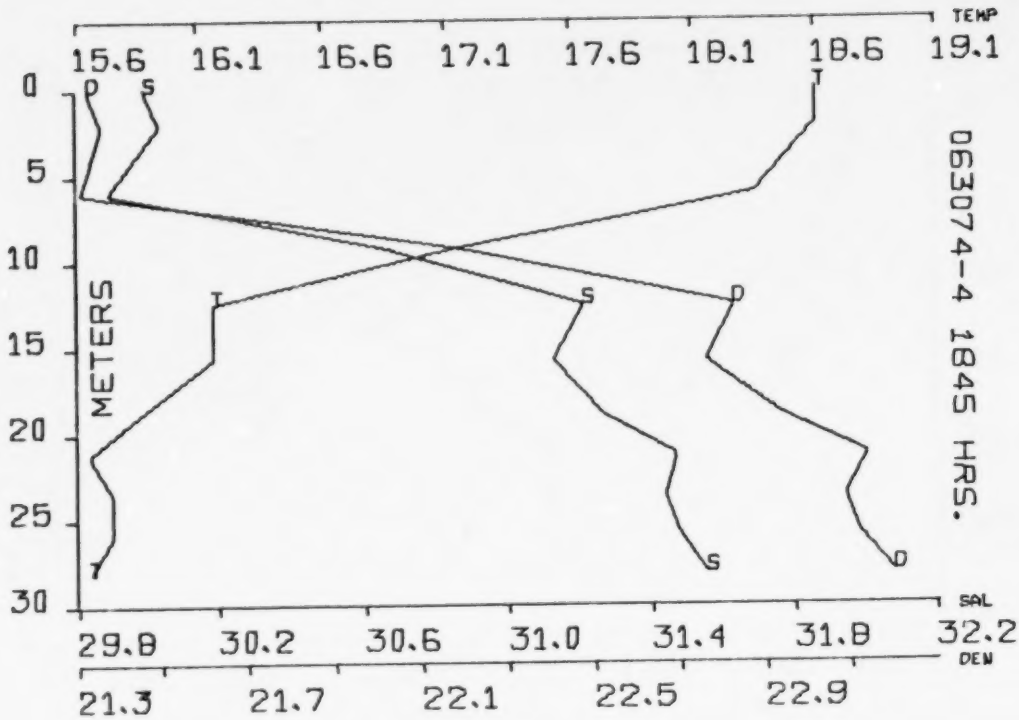
Depth (M)	Salinity (PPT)	Temperature (c)	Sigma-T
0	31.02	17.50	22.37
2.0	31.06	17.40	22.42
4.0	31.10	17.40	22.45
6.0	30.97	17.34	22.37
8.0	31.24	16.20	22.84
10.0	31.52	15.86	23.13
12.0	31.84	15.58	23.43
14.0	31.82	15.62	23.41
18.0	31.79	15.57	23.40
22.0	31.86	15.54	23.46
26.0	31.82	15.54	23.43

Figure B-4 Station 063074-2, 1440 EDT; Salinity, Temperature, and Sigma-t vs Depth



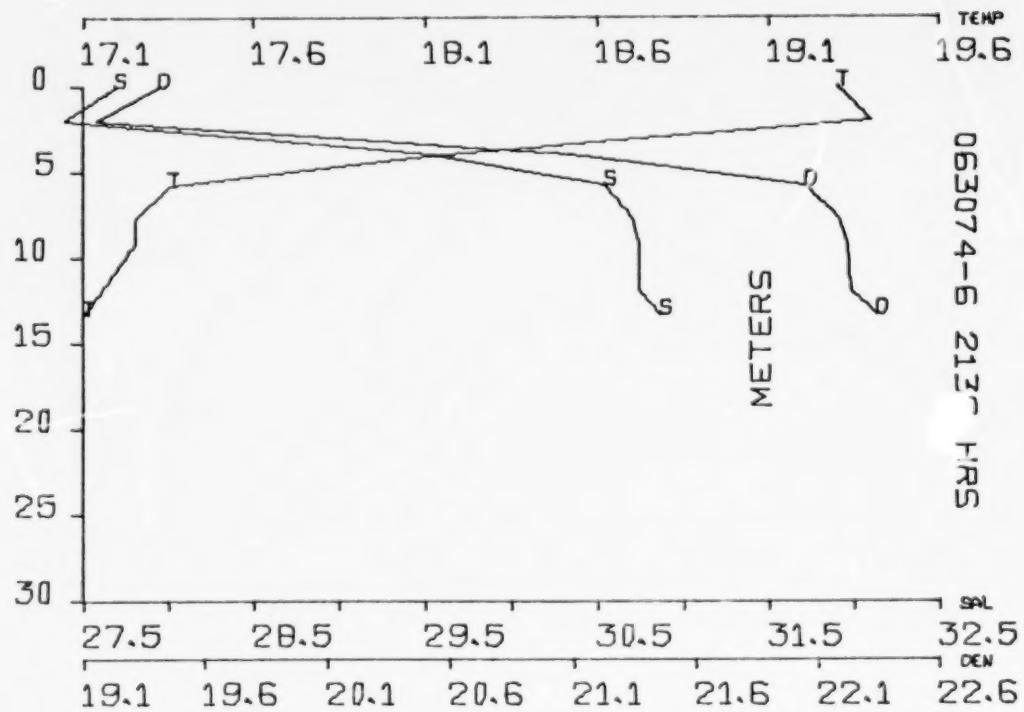
Depth, M	% T	A, m^{-1}
1.5	9	2.41
3.0	11	2.21
4.6	12	2.12
6.1	14	1.97
7.6	13	2.04
9.1	16	1.83
10.7	15	1.90
12.2	12	2.12
13.7	17	1.77
15.2	18	1.71
16.8	20	1.61
18.3	26	1.35
19.8	28	1.27
21.3	28	1.27
22.9	28	1.27

Figure B-5 Station 063074-3, 1620 EDT; Transmittance vs Depth



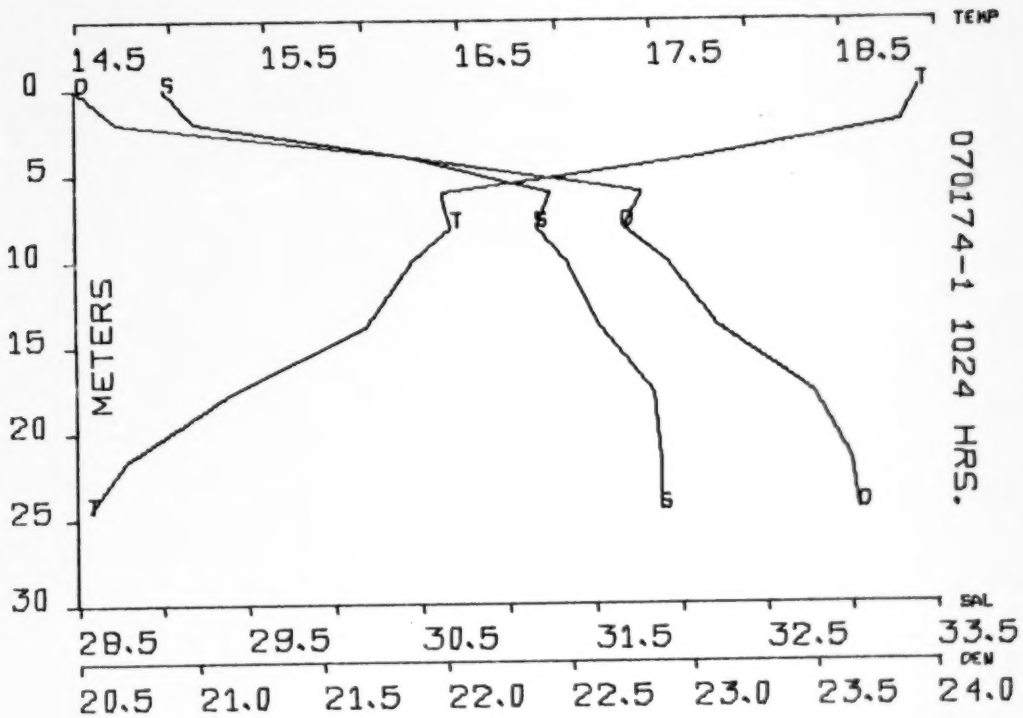
Depth (M)	Salinity (PPT)	Temperature (C)	Sigma-T
0	29.99	18.60	21.33
2.0	30.03	18.60	21.36
6.0	29.89	18.35	21.31
9.2	30.65	17.15	22.17
12.5	31.21	16.15	22.82
15.7	31.12	16.15	22.76
18.9	31.27	15.85	22.94
21.2	31.47	15.65	23.14
23.5	31.43	15.75	23.09
25.8	31.47	15.75	23.12
28.1	31.55	15.65	23.20

Figure B-6 Station 063074-4, 1845 EDT; Salinity, Temperature and Sigma-t vs Depth



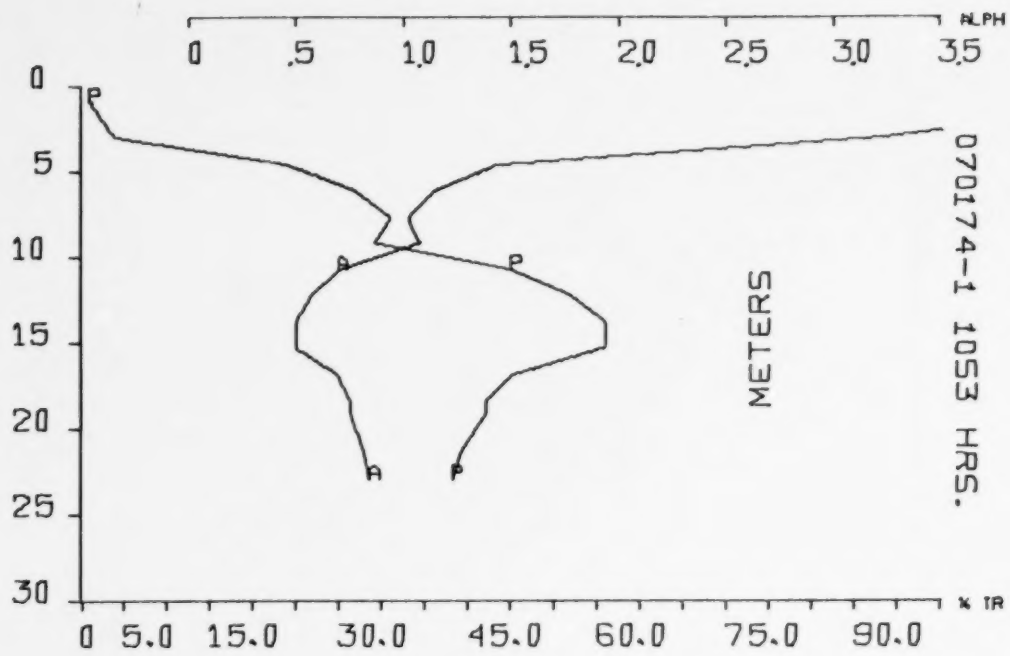
Depth (M)	Salinity (PPT)	Temperature (C)	Sigma-T
0	27.69	19.30	19.41
2.0	27.38	19.40	19.15
4.0	29.54	18.15	21.09
5.8	30.54	17.35	22.04
7.7	30.70	17.25	22.19
9.1	30.74	17.25	22.22
11.9	30.73	17.15	22.24
13.3	30.86	17.10	22.34

Figure B-7 Station 063074-6, 2136 EDT; Salinity, Temperature and Sigma-t vs Depth



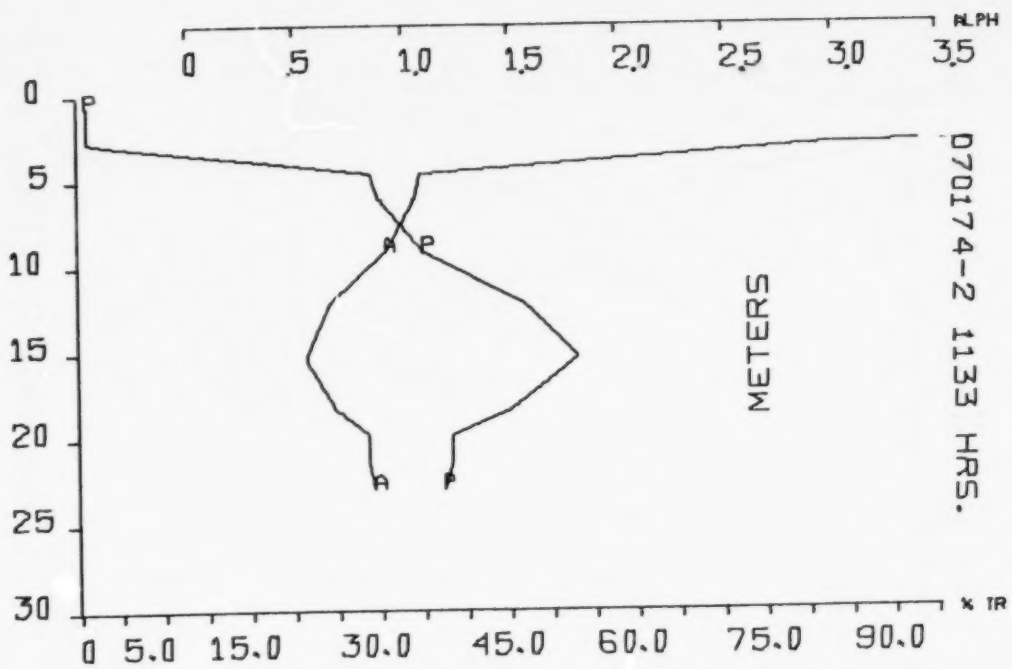
Depth (M)	Salinity (PPT)	Temperature (C)	Sigma-T
0	29.01	18.90	20.50
2.0	29.20	18.80	20.67
4.0	30.45	17.75	21.88
6.0	31.23	16.40	22.79
8.0	31.15	16.45	22.71
10.0	31.33	16.25	22.90
13.9	31.52	16.00	23.10
17.7	31.84	15.30	23.50
21.6	31.88	14.75	23.65
24.5	31.87	14.55	23.68

Figure B-8 Station 070174-1, 1024 EDT; Salinity, Temperature, and Sigma-t vs. Depth



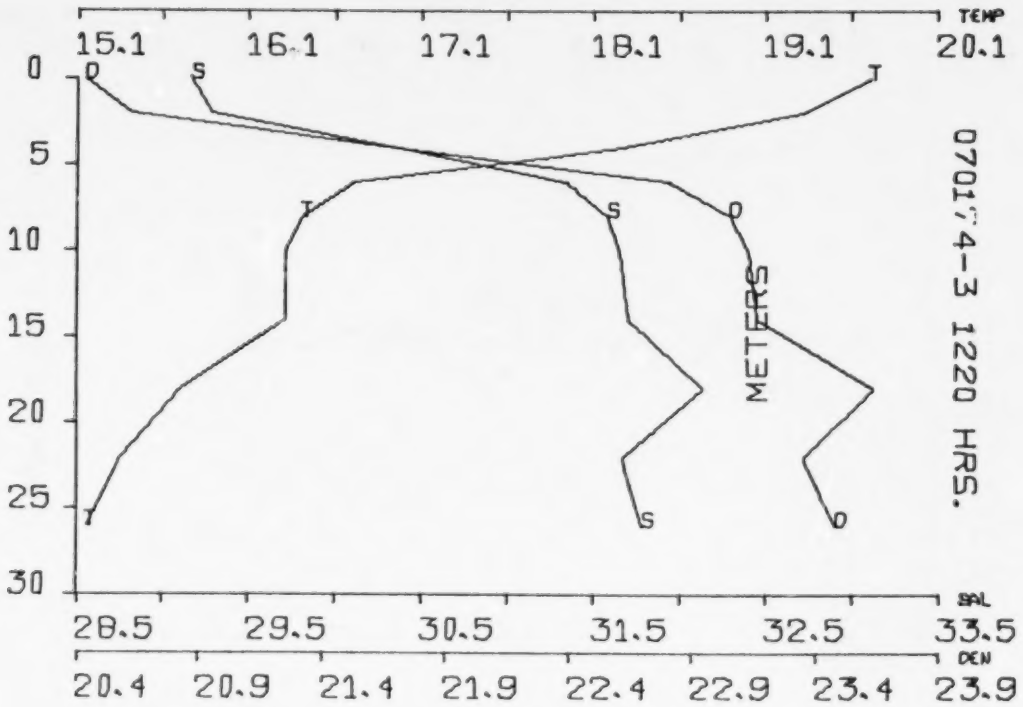
Depth, M	% T	A, m^{-1}
.9	0	∞
3.0	4	3.22
4.6	24	1.43
6.1	32	1.14
7.6	36	1.02
9.1	34	1.08
10.7	50	.69
12.2	57	.56
13.7	61	.49
15.2	61	.49
16.8	50	.69
18.3	47	.76
19.0	47	.76
21.3	44	.82
22.9	43	.84

Figure B-9 Station 070174-1, 1053 EDT; Transmittance vs Depth



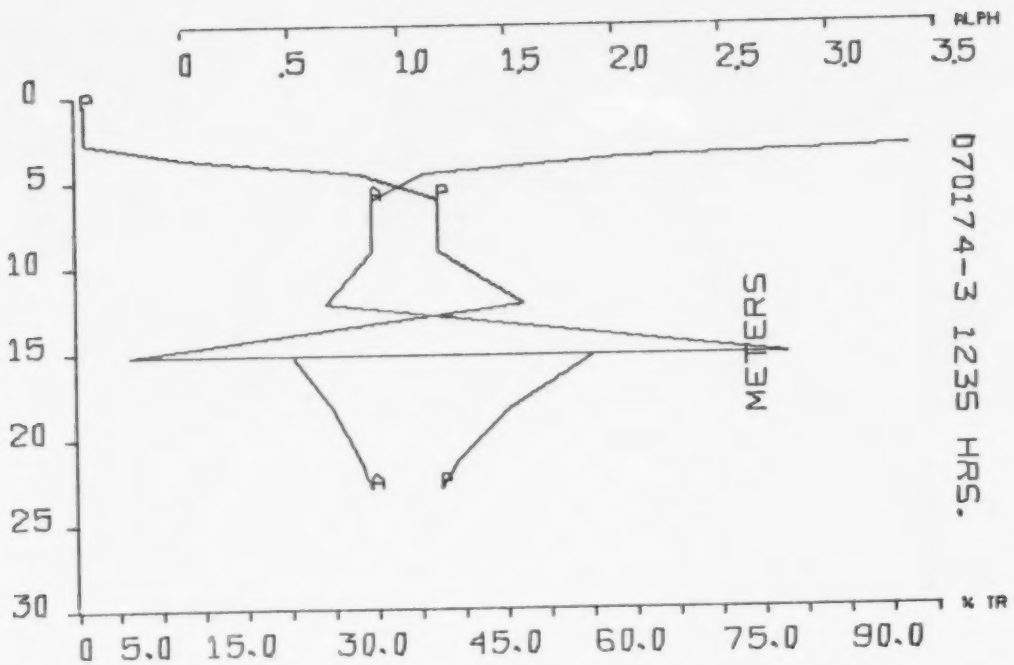
Depth, M	% T	A, m^{-1}
.6	0	∞
2.7	0	∞
3.0	5	3.00
4.6	34	1.08
6.1	35	1.05
9.1	40	.92
12.2	52	.65
15.2	58	.54
18.3	50	.69
19.8	43	.84
21.3	43	.84
22.9	42	.87

Figure B-10 Station 070174-2, 1133 EDT; Transmittance vs Depth



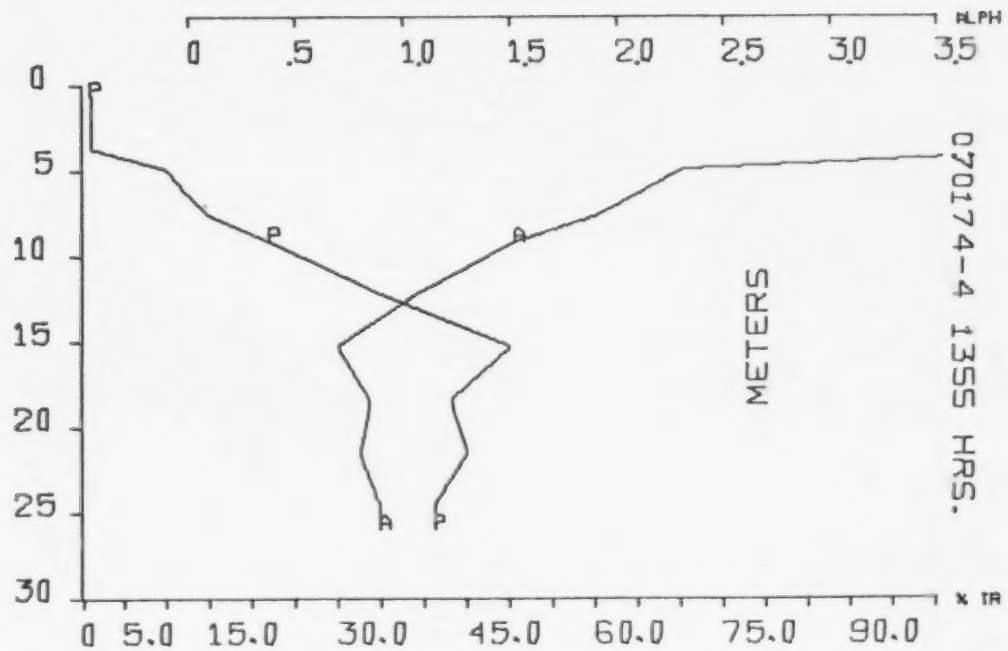
Depth (M)	Salinity (PPT)	Temperature (C)	Sigma-T
0	29.17	19.70	20.43
2.0	29.29	19.30	20.62
4.0	30.37	18.25	21.70
6.0	31.34	16.70	22.80
8.0	31.57	16.40	23.05
10.0	31.65	16.30	23.13
14.0	31.70	16.30	23.17
18.0	32.13	15.70	23.63
22.0	31.66	15.35	23.35
26.0	31.78	15.15	23.48

Figure B-11 Station 070174-3; 1220 EDT; Salinity, Temperature, and Sigma-t vs Depth



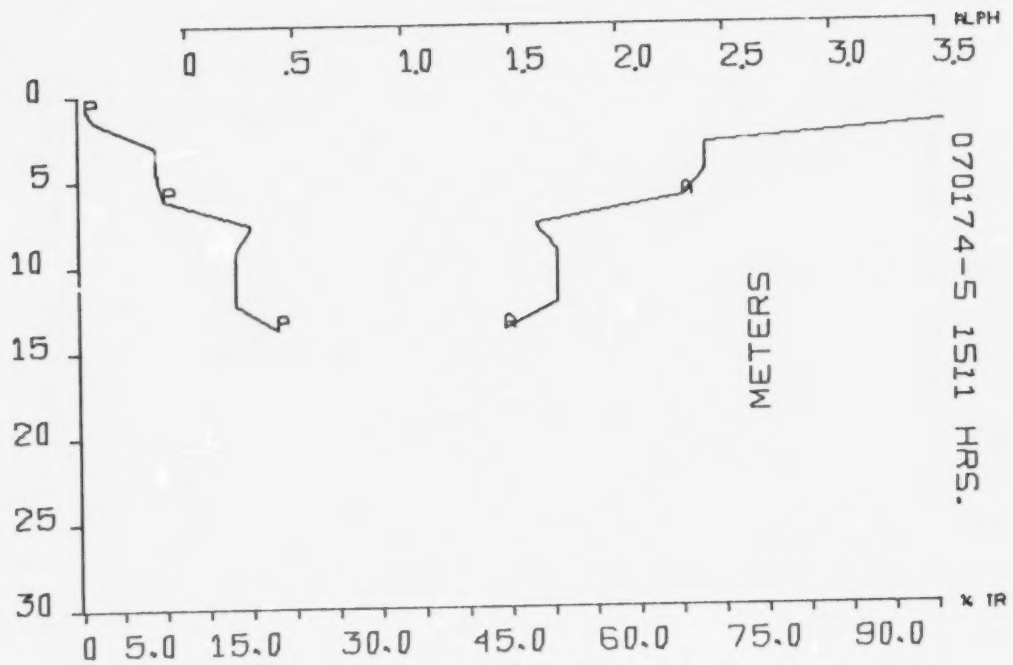
Depth, M	% T	A, m^{-1}
.5	0	∞
.9	0	∞
1.8	0	∞
2.7	1	4.61
3.7	13	2.04
4.6	33	1.11
6.1	42	.87
9.1	42	.87
12.2	52	.65
15.2	60	.51
18.3	50	.69
21.3	44	.82
22.9	42	.87

Figure B-12 Station 070174-3, 1235 EDT; Transmittance vs Depth



Depth, M	% T	A, m^{-1}
.6	0	∞
.9	0	∞
1.5	0	∞
2.4	0	∞
3.7	0	∞
4.9	10	2.30
6.1	12	2.12
7.6	15	1.90
9.1	22	1.51
12.2	35	1.05
15.2	50	.69
18.3	43	.84
21.3	45	.80
24.4	41	.89
25.9	41	.89

Figure B-13 Station 070174-4, 1355 EDT; Transmittance vs Depth



Depth, M	% T	A, m^{-1}
0.9	0	∞
1.5	2	3.91
3.0	8-10	2.53-2.30
4.6	7-12	2.65-2.12
6.1	7-13	2.65-2.04
7.6	20	1.61
9.1	18	1.71
10.7	18	1.71
12.2	18	1.71
13.7	23	1.47

Figure B-14 Station 070174-5, 1511 EDT; Transmittance vs Depth

Table B-8. STATION 070174-1, 1105 EDT; CURRENT PROFILE

Depth, M.	Resolved Currents Speed, Kts	Direction °T
1.2	0.68	045
3.8	0.28	226
6.9	0.28	221
9.9	0.32	204
13.0	0.12	190
16.0	0.12	307
19.0	0.32	036
22.1	0.39	040

Table B-9. STATION 070174-3, 1220 EDT; CURRENT PROFILE

Depth, M.	Resolved Currents Speed Kts	Direction °T
1.5	0.54	014
3.8	0.43	359
6.9	0.31	284
9.9	0.26	232
13.0	0.13	233
16.0	0.29	041
19.0	0.39	040
22.1	0.39	040

PART IV, APPENDIX B
Total Suspended Matter; Size Analyses; Examples
of Detailed Tables and Graphs

Discussion and Explanation of Table and Graph Headings

Size analyses with the Coulter Counter^{R} and the subsequent data reduction results in two pages of computer output for each sample, a page of tabulated data and a plot of the size frequency distribution. Because of the bulk of material (more than 150 pages for these samples), these detailed outputs are not included in this data report; rather, examples of the outputs are presented here as Figures B-15 and B-16. These data are on file at the Corvallis Environmental Research Laboratory.

For identification purposes each column or header of the particle size table (Figure B-15) has been identified with a number which is listed and explained below.

1. SAMPLE IDENTIFICATION: Alpha-numeric codes were used to identify, uniquely, each sample collected only for total suspended matter analyses. A complete list of these codes cross-referencing them to standard station codes used during the June-July, 1974, cruise are found in Part V of this appendix. A similar list for the December, 1974, cruise is given in Appendix C.

2. Header Information Which Includes:

STUDY AREA:	The area from which the sample was collected and the year it was collected.
DATE:	The month and day it was collected.
TIME:	The local time at which sample was collected.
LATITUDE:	Latitude of the station, °N.
LONGITUDE:	Longitude of the station, °W.
WATER SAMPLE:	The type of sample collected.
WATER DEPTH:	Water depth, meters.
SAMPLE DEPTH:	Sample depth, meters.

CORE SAMPLE DEPTH FROM TOP OF CORE: For bottom cores, the depth of sample in the core, in centimeters.

DILUTION: The dilution factor required to obtain suitable instrumental analyses.

3. CHAN: Instrument data storage channel; a size class.

4. DIA U: The equivalent spherical diameter, in micrometers (μm) assigned to channel boundaries; in the example the lower and upper boundaries of channel 12 are 4.00 and 5.04 micrometers, (.004 mm and .00504 mm) respectively.

5. MN VOL CU: The geometric mean volume, in cubic micrometers $(\mu m)^3$ of the given channel.

6. PHI VALUE: The phi value, Ø, of the geometric mean diameter of a given channel.

$$\emptyset = -\left[\frac{\frac{\log A + \log B}{2}}{\log 2}\right]$$

where A = channel lower boundary; diameter in millimeters

B = channel upper boundary; diameter in millimeters

7. DELTA PRAW: The gross population of electrical impulses registered as particles in given instrument channels; the raw particle count.

8. DELTA P BKG. The population of impulses registered as apparent particles in given instrument channels from analysis of clean electrolyte; the background count.

9. DELTA P NET: The net population of particles in a given channel per liter of sample (Note that from this point on, all values given refer to population or volume per liter of original sample (i.e., the "true" population or volume).

10. SUM P NET: The cumulative population of particles per liter.

11. DELTA P %: The particle population of a given channel expressed as a percent of the total population.

12. SUM P %: The cumulative population of particles expressed in percent.

13. DELTA V CU: The volume of particles, in cubic micrometers, $(\mu m)^3$, in a given channel, per liter.

14. SUM V CU: The cumulative volume of particles in cubic micrometers per liter.

15. DELTA V %: The volume of particles in a given channel expressed as a percent of the total volume of particles.

16. SUM V %: The cumulative volume of particles expressed in percent.

17. PPM: The concentration of particles per channel, per liter, expressed in parts per million by volume.

18. Header information which includes:

SAMPLE: Sample identification

DEPTH: Sample depth, meters

MEDIAN: The median equivalent diameter expressed as Ø.

MEAN: The mean equivalent diameter expressed as Ø.

STDEV: The standard deviation expressed in phi notation.

SKEWNESS: Skewness of the size frequency curve.

KURTOSIS: Kurtosis of the size frequency curve.

19. FIFTY PERCENTILE VOLUME: The particle volume, in cubic micrometers, of the 50th percentile.

The size frequency distribution (Figure B-16) shows the percent, by volume, of particulate matter plotted against the instrument channel numbers (size classes). The various headings of the figure are numbered, for identification, and explained below.

1. SAMPLE IDENTIFICATION: The same identification shown as Item 1, Figure B-15.

2. VOLUME %: The ordinate label.

3.	CHANNEL NUMBER: (From 2.962 to 194.4E3 CU) CU Channel	The abscissa label giving the volume size range of the analyses. This particular example ranges from 2.962 cubic micrometers to 194.4E3 (194,000) cubic micrometers. (Note: Size decreases from right to left; 194.4E3 is the mean geometric volume of channel 0 and 2.962 CU is the mean geometric volume of Channel 16). Refer to the column identified as item Number 6 in Figure B-15 to determine the mean geometric diameter for any channel.
4.	SAMPLE DEPTH:	Sample depth, meters. In this example, the depth is 10 meters.
5.	FIFTY PERCENTILE VOLUME:	The particle volume, in cubic micrometers, which marks the 50th percentile.

(1) ********** *NC174062710LUG * **********

(2) STUDY AREA:NEW YORK 1974 DATE:0627 TIME:1000 LATITUDE:40 24.7N LONGITUDE:73 44.8W
WATER SAMPLE WATER DEPTH:0026 M SAMPLE DEPTH:0010 M CORE SAMPLE DEPTH FROM TOP OF CORE: CM DILUTION: 3

(3) CHAN	(4) DIA U	(5) MN VOL. CU	(6) PHI VALUE	(7) DELTA PRAW	(8) DELTA PBKG	(9) DELTA P NET	(10) SUM P NET	(11) DELTA P %	(12) SUM P %	(13) DELTA V CU	(14) SUM V CU	(15) DELTA V %	(16) SUM V %	(17) PPM
16	1.59	2.962	9.132	21951	525	3.214E 07	8.179E 07	39.29	100.00	9.520E 07	4.038E 09	2.36	100.00	.0952
15	2.00	5.924	8.799	12748	254	1.874E 07	4.965E 07	22.91	60.71	1.110E 08	3.943E 09	2.75	97.64	.1110
14	2.52	11.85	8.466	8597	123	1.271E 07	3.091E 07	15.54	37.79	1.506E 08	3.832E 09	3.73	94.89	.1506
13	3.17	23.70	8.132	5412	61	8.025E 06	1.820E 07	9.81	22.25	1.902E 08	3.681E 09	4.71	91.16	.1902
12	4.00	47.39	7.799	3309	32	4.916E 06	1.018E 07	6.01	12.44	2.329E 08	3.491E 09	5.77	86.45	.2329
11	5.04	94.78	7.466	1590	12	2.367E 06	5.260E 06	2.89	6.43	2.243E 08	3.258E 09	5.56	80.68	.2243
10	6.35	198.6	7.132	849	4	1.267E 06	2.894E 06	1.55	3.54	2.402E 08	3.034E 09	5.95	75.13	.2402
9	8.00	379.1	6.799	481	0	7.210E 05	1.627E 06	.88	1.99	2.733E 08	2.794E 09	6.77	69.18	.2733
8	10.1	758.3	6.466	274	0	4.105E 05	9.055E 05	.50	1.11	3.113E 08	2.520E 09	7.71	62.41	.3113
7	12.7	1516.	6.133	157	0	2.355E 05	4.950E 05	.29	.61	3.570E 08	2.209E 09	8.84	54.70	.3570
6	16.0	3033.	5.799	92	0	1.385E 05	2.595E 05	.17	.32	4.201E 08	1.852E 09	10.40	45.86	.4201
5	20.2	6066.	5.466	47	0	7.100E 04	1.210E 05	.09	.15	4.307E 08	1.432E 09	10.67	35.46	.4307
4	25.4	12.13E3	5.133	22	0	3.350E 04	5.000E 04	.04	.06	4.064E 08	1.001E 09	10.06	24.79	.4064
3	32.0	24.27E3	4.799	8	0	1.150E 04	1.650E 04	.01	.02	2.791E 08	5.948E 08	6.91	14.73	.2791
2	40.3	48.54E3	4.466	2	0	3.500E 03	5.000E 03	.00	.01	1.699E 08	3.157E 08	4.21	7.82	.1699
1	50.8	97.18E3	4.132	1	0	1.500E 03	1.500E 03	.00	.00	1.458E 08	1.458E 08	3.61	3.61	.1458
0	64.0	194.4E3	3.798	1	0	0E 00	0E 00	0	0	0E 00	0E 00	0	0	0

(18)

SAMPLE	DEPTH	MEDIAN	MEAN	STDEV	SKEWNESS	KURTOSIS	
NC174062710LUG	0010	5.955	6.317	1.291	.361	2.227	MOMENT STATISTICS PHI VALUES

(19) FIFTY PRECENTILE VOLUME IS 2191.834 CU

Figure B-15 Example of tabulated data

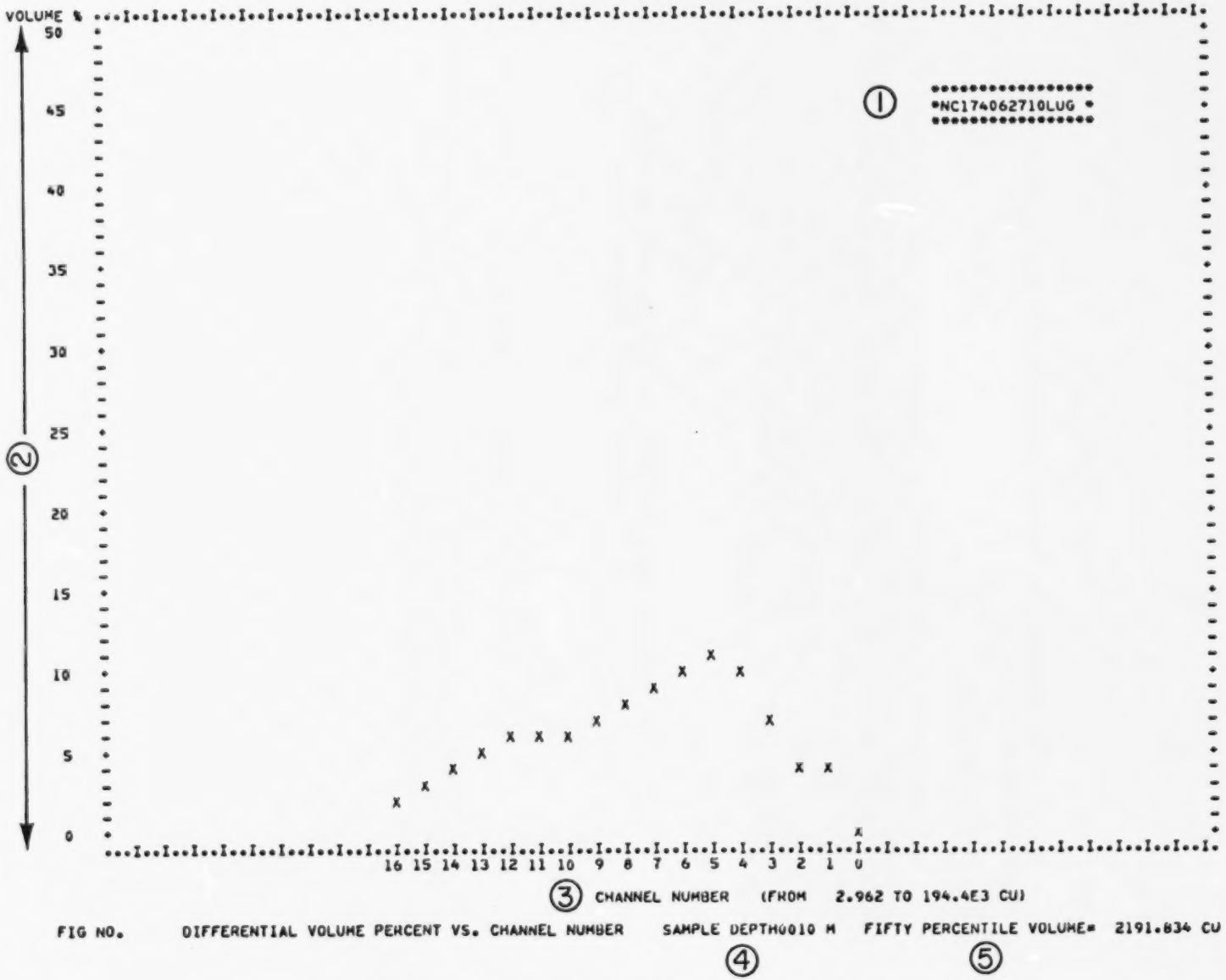


Figure B-16 Example of size frequency curve

PART V, APPENDIX B

Tables cross-referencing station identification and particle size sample designations.

Explanation of Tables

An alpha-numeric code of up to 15 characters was used to uniquely identify each sample or subsample used exclusively for TSM size analysis. These codes identify each particle-size table and graph, examples of which are shown as Figures B-15 and B-16 in Part IV of this appendix. Complete lists of these codes and the corresponding standard station and depth designation are given in Tables B-10, B-11 and B-12 for samples collected in the wake of vessel Newtown Creek, on the traverse, and in the wake of the vessel Owls Head. An example is given below.

NC 1 74062720LUG

NC1:	The station identification, in this example the first station occupied in wake of vessel Newtown Creek.
74:	The year
06:	The month
27:	The day
20:	Sample depth, meters
LUG:	Preservative; in this example, Lugol's solution.

In this report, particle size is often described by equivalent diameter or the corresponding phi (Ø) value. Table B-13 gives diameter values in millimeters and micrometers along with corresponding phi values.

Table B-10. CROSS REFERENCE: TOTAL SUSPENDED MATTER SAMPLE IDENTIFICATION VERSUS STANDARD STATION IDENTIFICATION: WAKE OF DISPOSAL VESSEL NEWTOWN CREEK; JUNE 27, 1974

Total Suspended Matter Sample Identification	Standard Station Identification	Sample Depth Meters
NC174062700LUG	062774-1	0
NC174062705LUG		5
NC174062710LUG		10
NC174062715LUG		15
NC174062720LUG		20
NC274062700LUG	062774-2	0
NC274062705LUG		5
NC274062710LUG		10
NC274062715LUG		15
NC274062720LUG		20
NC374062700LUG	062774-3	0
NC374062705LUG		5
NC374062710LUG		10
NC374062715LUG		15
NC374062720LUG		20
NC474062700LUG	062774-4	0
NC474062705LUG		5
NC474062710LUG		10
NC474062715LUG		15
NC474062720LUG		20
NC474062725LUG		25
NC574062700LUG	062774-5	0
NC574062705LUG		5
NC574062710LUG		10
NC574062715LUG		15
NC574062720LUG		20
NC574062725LUG		25

Table B-11. CROSS REFERENCE: TOTAL SUSPENDED MATTER SAMPLE IDENTIFICATION VERSUS STANDARD STATION IDENTIFICATION: TRAVERSE BUOY "NB" - NEW YORK HARBOR; JUNE 30, 1974

Total Suspended Matter Sample Identification	Standard Station Identification	Sample Depth Meters
BYNB74063000LUG	063074-1	0
BYNB74063005LUG		5
BYNB74063010LUG		10
BYNB74063020LUG		20
BYNB74063030LUG		30
TR1 74063000LUG	063074-2	0
TR1 74063005LUG		5
TR1 74063010LUG		10
TR1 74063020LUG		20
TR1 74063028LUG		28
TR2 74063000LUG	063074-3	0
TR2 74063005LUG		5
TR2 74063010LUG		10
TR2 74063020LUG		20
TR2 74063025LUG		25
TR3 74063000LUG	063074-4	0
TR3 74063005LUG		5
TR3 74063010LUG		10
TR3 74063020LUG		20
TR3 74063025LUG		25
501 74063000LUG	063074-5	0
501 74063005LUG		5
501 74063010LUG		10
501 74063020LUG		20
501 74063025LUG		25
BYA 74063000LUG	063074-6	0
BYA 74063005LUG		5
BYA 74063010LUG		10
BY5 74063000LUG	063074-7	0
BY5 7406302.5LUG		2.5
BY5 74063005LUG		5

Table B-12. CROSS REFERENCE: TOTAL SUSPENDED MATTER SAMPLE IDENTIFICATION VERSUS STANDARD STATION IDENTIFICATION: WAKE OF DISPOSAL VESSEL OWLS HEAD; JULY 1, 1974

Total Suspended Matter Sample Identification	Standard Station Identification	Sample Depth Meters
OH174070100LUG	070174-1	0
OH174070105LUG		5
OH174070110LUG		10
OH174070120LUG		20
OH174070124LUG		24
OH274070100LUG	070174-2	0
OH274070104LUG		4
OH274070115LUG		15
OH274070120LUG		20
OH274070124LUG		24
OH374070100LUG	070174-3	0
OH374070103LUG		3
OH374070105LUG		5
OH374070110LUG		10
OH374070124LUG		24
OH474070100LUG	070174-4	0
OH474070103LUG		3
OH474070105LUG		5
OH474070110LUG		10
OH474070120LUG		20

Table B-13. CONVERSION OF EQUIVALENT DIAMETERS, IN MILLIMETERS, TO PARTICLE DIAMETER IN PHI NOTATION*

Millimeters	Ø	Micrometers**
1	0	1000
1/2	1	500
1/4	2	250
1/8	3	125
1/16	4	62.5
1/32	5	31.2
1/64	6	15.6
1/128	7	7.8
1/256	8	3.9
1/512	9	2.0
1/1024	10	1.0

* $\emptyset = -\log_2 E$ [E = diameter in millimeters; Krumbein and Pettijohn (1936)].

** Values are rounded to 0.1 μm.

APPENDIX C
DECEMBER, 1974 CRUISE

Introduction and Discussion of Information Included

On December 18, 19, and 20, water samples were collected in the wake of the vessel Newtown Creek as it discharged sewage sludge. Resulting total suspended matter data are included in Tables C-1, C-2, and C-3. The format of these tables are the same as those of the June-July, 1974, cruise except that no salinity or concentration of TSM values are included. Tables C-4, C-5, and C-6 cross reference total suspended matter sample identifications with standard station and depth designations. The coding for these identifications follow the same format as has been given for those samples collected during the June-July, 1974, cruise.

Table C-1 New York Bight, Total Suspended Matter, Wake of Disposal Vessel Newtown Creek, December 18, 1974.

Table C-2 New York Bight, Total Suspended Matter, Wake of Disposal Vessel Newtown Creek, December 19, 1974.

Table C-3 New York Bight, Total Suspended Matter, Wake of Disposal Vessel Newtown Creek, December 20, 1974.

Table C-4 Cross Reference, Total Suspended Matter Sample Identification versus Standard Station Identification, Wake of Disposal Vessel Newtown Creek, December 18, 1974

Table C-5 Cross Reference, Total Suspended Matter Sample Identification Versus Standard Station Identification Wake of Disposal Vessel Newtown Creek, December 19, 1974.

Table C-6 Cross Reference, Total Suspended Matter Sample Identification Versus Standard Station Identification, Wake of Disposal Vessel Newtown Creek, December 20, 1974.

Table C-1. NEW YORK BIGHT: TOTAL SUSPENDED MATTER; WAKE OF DISPOSAL VESSEL NEWTOWN CREEK; DECEMBER 18, 1974

Station	Latitude	Longitude	Time EST	Depth Meters	Total Suspended Matter Particle Size Data: Mean Size Equivalent Diameter µM	Mean Size Equivalent Diameter Ø	Standard Deviation Phi Units
121874-1	40°24.9'N	73°44.8'W	0750 0850			Not Taken	
121874-2	40°24.9'N	73°44.8'W	0946 1100	0	10.10	6.63	0.98
				2	8.09	6.95	1.07
				10	9.36	6.74	0.98
				15	11.76	6.41	0.95
				20	7.19	7.12	1.37
121874-3	40°25.8'N	73°44.3'W	1110 1202	0	6.85	7.19	1.30
				5	10.31	6.60	1.06
				10	9.29	6.75	1.10
				15	7.34	7.09	1.27
				20	11.05	6.50	1.11
121874-4	40°24.6'N	73°43.8'W	1230 1301	0	9.29	6.75	1.15
				5	11.05	6.50	1.21
				10	6.17	7.34	1.28
				15	10.45	6.58	1.17
				18	12.09	6.37	1.15
121874-5	40°24.4'N	73°41.7'W	1328 1355	0	7.92	6.98	1.39
				5	8.49	6.88	1.30
				9	7.81	7.00	1.35
				14	7.34	7.09	1.30
				17	5.92	7.40	1.38
121874-6	40°24.2'N	73°44.8'W	1412 1420			Not Taken	

Table C-2. NEW YORK BIGHT: TOTAL SUSPENDED MATTER; WAKE OF DISPOSAL VESSEL NEWTOWN CREEK; DECEMBER 19, 1974

Station	Latitude	Longitude	Time EST	Depth Meters	Total Suspended Matter Particle Size Data Mean Size Equivalent Diameter µM	Mean Size Diameter Ø	Standard Deviation Phi Units
121974-1	40°24.7'N	73°44.7'W	0842	0	6.13	7.35	1.01
			0955	5	5.34	7.55	1.25
				9	6.26	7.32	1.26
				14	10.67	6.55	1.55
				18	13.42	6.22	1.25
121974-2	40°24.7'N	73°44.7'W	1235	0	8.97	6.80	0.99
			1256	4	11.68	5.42	0.85
				9	8.67	6.85	0.95
				14	10.60	6.56	1.22
				19	13.98	6.16	1.30
121974-3	40°24.7'N	73°44.1'W	1323	0	7.87	6.99	1.47
			1409	5	7.34	7.09	1.17
				10	6.62	7.24	1.16
				15	7.60	7.04	1.36
				20	7.09	7.14	1.33
121974-4	40°25.3'N	73°42.7'W	1430	0	6.26	7.32	1.10
			1502	5	7.92	6.98	0.91
				10	9.29	6.75	0.99
				15	7.60	7.04	1.35
				20	10.10	6.63	1.31
121974-5	40°25.7'N	73°41.7'W	1529	0	7.04	7.15	1.00
			1540	5	8.14	6.94	1.14
				10	6.62	7.24	1.30
				15	7.92	6.98	1.31
				20	9.82	6.67	1.47
121974-6	40°25.7'N	73°45.3'W	1600			Not Taken	
			1602				

Table C-3. NEW YORK BIGHT: TOTAL SUSPENDED MATTER; WAKE OF DISPOSAL VESSEL NEWTOWN CREEK; DECEMBER 20, 1974

Station	Latitude	Longitude	Time EST	Depth Meters	Total Suspended Matter Particle Size Data		
					Mean Size Equivalent Diameter μM	Mean Size Diameter Ø	Standard Deviation Phi Units
122074-1	40°24.7'N	73°44.7'W	1007 1010	0	5.34	7.55	1.32
122074-2	40°24.7'N	73°44.7'W	1020 1043	0	12.69	6.30	1.56
				4	13.98	6.16	1.47
				9	12.69	6.30	1.49
				14	12.26	6.35	1.34
				18	9.75	6.68	1.40
122074-3	40°24.1'N	73°44.9'W	1117 1153			Not Taken	
122074-4	40°23.8'N	73°45.0'W	1232 1232			Not Taken	

Table C-4. CROSS REFERENCE: TOTAL SUSPENDED MATTER SAMPLE IDENTIFICATION; WAKE OF DISPOSAL VESSEL NEWTOWN CREEK; DECEMBER 18, 1974

Total Suspended Matter Sample Identification	Standard Station Identification	Sample Depth Meters
None Taken	121874-1	--
NC174121800LUG	121874-2	0
NC174121802LUG		2
NC174121810LUG		10
NC174121815LUG		15
NC174121820LUG		20
NC274121800LUG	121874-3	0
NC274121805LUG		5
NC274121810LUG		10
NC274121815LUG		15
NC274121820LUG		20
NC374121800LUG	121874-4	0
NC374121805LUG		5
NC374121810LUG		10
NC374121815LUG		15
NC374121820LUG		18
NC474121800LUG	121874-5	0
NC474121805LUG		5
NC474121810LUG		9
NC474121815LUG		14
NC474121820LUG		17
Not Taken	121874-6	--

Table C-5. CROSS REFERENCE: TOTAL SUSPENDED MATTER SAMPLE IDENTIFICATION VERSUS STANDARD STATION IDENTIFICATION; WAKE OF DISPOSAL VESSEL NEWTOWN CREEK; DECEMBER 19, 1974

Total Suspended Matter Sample Identification	Standard Station Identification	Depth Meters
NC174121900LUG	121974-1	0
NC174121905LUG		5
NC174121910LUG		9
NC174121915LUG		14
NC174121920LUG		18
NC274121900LUG	121974-2	0
NC274121905LUG		4
NC274121910LUG		9
NC274121915LUG		14
NC274121920LUG		19
NC374121900LUG	121974-3	0
NC374121905LUG		5
NC374121910LUG		10
NC374121915LUG		15
NC374121920LUG		20
NC474121900LUG	121974-4	0
NC474121905LUG		5
NC474121910LUG		10
NC474121915LUG		15
NC474121920LUG		20
NC575121900LUG	121974-5	0
NC574121905LUG		5
NC574121910LUG		10
NC574121915LUG		15
NC574121920LUG		20
Not Taken	121974-6	--

Table C-6. CROSS REFERENCE: TOTAL SUSPENDED MATTER SAMPLE IDENTIFICATION VERSUS STANDARD STATION IDENTIFICATION; WAKE OF DISPOSAL VESSEL NEWTOWN CREEK; DECEMBER 20, 1974

Total Suspended Matter Sample Identification	Standard Station Identification	Depth Meters
NC174122000LUG	122074-1	0
NC274122000LUG	122074-2	0
NC274122005LUG		4
NC274122010LUG		9
NC274122015LUG		14
NC274122020LUG		18
Not Taken	122074-3	--
Not Taken	122074-4	--